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The Terry Lectures

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Fate and Freedom

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Concerning Evolution.
By *J. Arthur Thomson.*

Evolution in Science and Religion.
By *Robert Andrews Millikan.*

Fate and Freedom.
By *Henry Norris Russell.*

FATE AND FREEDOM

BY

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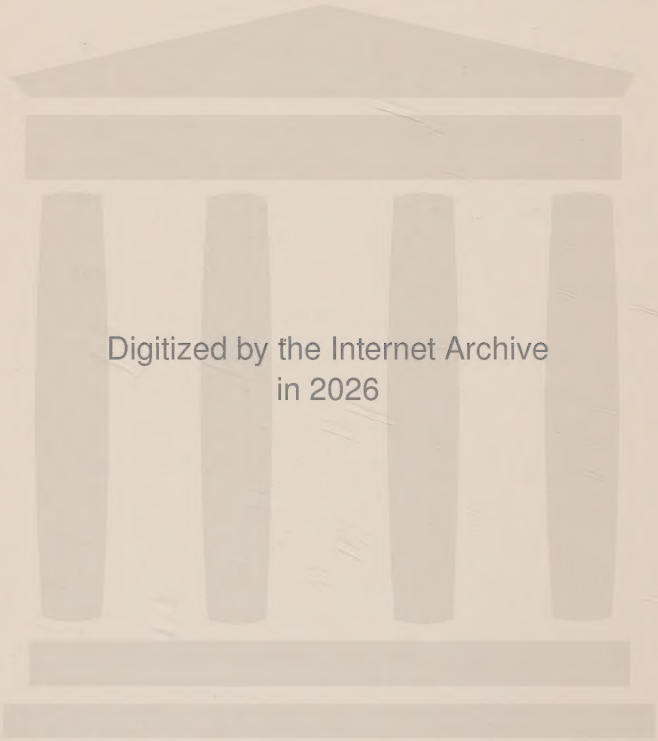
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PREFACE

THE Terry Lectures on Religion in the Light of Science and Philosophy are, by the terms of their foundation, to be delivered under the auspices of Yale University at New Haven and also at the Community Forum of the United Congregational Church in Bridgeport; and published by the Yale University Press.

The present volume contains the lectures given in 1925. While the substance of the two sets of lectures was the same, the manner of presentation differed somewhat in the two cases; and, in their present form, the material has again been reworked and considerably expanded. The lecture form of presentation has, however, been retained, which accounts for the appearance of the first personal pronoun.

With respect to the subject matter, it need only be said that it represents conclusions which the writer has reached after considerable thought upon these topics and discussion with many friends. The standpoint is throughout one of full acceptance of the mechanistic theory of nature,—including hu-

man nature,—not as a demonstrated natural law, but as a working hypothesis. The main thesis is that this hypothesis, far from being hostile to religion, and to the Christian religion in particular, is capable of rendering religion important services. If what is here written proves of any help toward the resolving, for some of its readers, of the problems which are so pressing in our time, it will have served its purpose.

I.

FATE AND FREEDOM

FATE AND FREEDOM

THERE is a great deal of discussion today about the "conflict" between science and religion. It is supposed by many people that modern science is a dangerous foe to religion, and many others, who are too well educated to fall into this error, have nevertheless an uneasy feeling that the results of scientific investigation, though not directly hostile to religion, tend to make faith more difficult.

The reason why I, a student of the physical sciences, make bold to accept the invitation of Yale University and speak to you on religious topics is found in my conviction that this feeling is altogether ill-advised.

Religion, as I see the situation today, has nothing vital to lose by the frank and free acceptance of the results of science—neither by the full acknowledgment of those conclusions which are supported by a convincing weight of evidence, nor by the tentative acceptance of those hypotheses which, though not decisively established, have a considerable balance of probability in their favor. But this

negative statement covers only the less important side of the situation. Religion has a great deal to *gain* from science. The specific results of scientific work are often of positive aid to religion—resolving, or helping to resolve, some of its knottiest problems; and the methods of reasoning which scientific investigation has brought with it are, when rightly applied, no less helpful in the realm of religious thought.

For obvious reasons, the contact between science and religion has been mainly on the intellectual side of the religious field. The "warfare of science" has not been with religion, but with theology, and the gains which religion will derive from supplanting distrust by alliance will be found mainly in the theological realm.

It is a commonplace to say that every religious man must have some sort of a theology —some opinions, some convictions, some philosophy dealing with religious matters. A second commonplace regarding theology, and one, like the first, upon which theologians of very different schools are agreed, is that its subject-matter is in many parts very difficult, so that the keenest logic and the boldest im-

agination may falter in attempting such high things.

That scientific work trains and develops the logical faculty is another commonplace; we are more likely to forget, now-a-days, how valuable a training of the same faculties was provided by theology in earlier times. But what is very much less widely realized is the service which science is continually doing in the training of the human imagination. Imagination is often regarded as peculiarly the endowment of the artist. Yet artistic imagination, widely as it may range, still moves in the regions in which Patmore's words are true.

> Wonder and beauty our own courtiers are
> Pressing to meet our gaze
> And out of obvious ways
> Ne'er wandering far.

Its triumphs consist mainly in the arrangement of familiar elements of human experience into new combinations. The various disciplines which its divers followers must observe are all rightly numbered among the humanities. But science must range farther afield, and deal with things that, till within

the memory of living men—often of young men—were not within the realm of human experience at all. Facing the innumerable phenomena of Nature, she has advanced slowly, a step at a time, into the unknown, constructing her images, her working models or "laws," and making them over time and time again, so that they represent the phenomena more closely and over a wider range. Thus she has come to pictures of Nature—as in modern biology or, most of all, in modern physics—concerning which it may be said with literal truth that they surpass the wildest dreams of fancy. They are far too complicated, far too extraordinary, to have been the product of mere free-ranging, uncontrolled human imagination. Only the disciplined, coöperative imagination which strives not to please the taste, but to represent, as closely as may be, as large a portion as is practicable of the bewildering complex of phenomena, and in which the contributions of many men may join, could win so far. It could fairly be claimed that the study of Nature has thus brought a new and in certain respects a higher type of human imagination into action; and this expanded imagination has not

yet been applied as effectively as it might be in the consideration of religious problems.

The man of science, however, who has learned the effectiveness of this type of imagination, has also realized its limits. He never supposes that the latest model of some part of Nature which coöperative imagination has designed will turn out to be perfect. He knows too well how intricate, in reality, are the things which seem simplest, and long experience has taught him to anticipate that, as knowledge advances, his hypotheses and theories must undergo extensive change. Whenever these changes bring his models into closer conformity with the facts, he welcomes them,—or realizes at least that he *ought* to welcome them, whatever impulses to the contrary come from personal pride in his own superseded work, or from the pains and labor of assimilating new and complex ideas.

Even his knowledge of the facts is incomplete, and he knows it. For example, no measurement can be perfectly accurate,—owing to human imperfection, it must be more or less wrong,—and even the most precise results of physical measurement are therefore stated with an annexed "probable error,"

which tells how wide or narrow the limits of outstanding uncertainty remain. If the observations agree with a given theory within the limits set by this probable error, they support the theory, though this by no means proves that some other theory might not do as well. But if they do not so agree, something is wrong, and further work is in order to find out what it is.

Science is therefore continually recasting and altering her interpretations of phenomena—this is her method of progress. She does not regard her "laws"—even the law of gravitation—as statements of absolute truth, but rather as approximations to the truth, which she hopes to better when she knows more. Her attitude reminds one of the story (whether authentic or not matters little) of how the earliest settlers of Connecticut, being too busy with pioneer work to spend time upon long legislative sessions, passed in town-meeting an ordinance that the community "shall be governed by the laws of God as laid down by Moses, until we find time to make better."

The resulting attitude of mind is again one

which could hardly have been imagined in earlier times. The old hope of finding final and perfect statements of the truth about a simple universe has fled; in its place comes the realization of a steadily increasing accuracy of approximation in the description and interpretation of an incredibly and magnificently complex universe. The science—if such might be imagined—whose formularies had required and undergone no change in a generation would be a science at a standstill; perhaps one which had exhausted a limited field, more likely one which was frustrated, helpless before insurmountable barriers. Yet, all the while, no one supposes that the facts of Nature are changed because our understanding of them grows.

Practically all the existing theological formularies antedate this great change of intellectual attitude. Is it any wonder that a new generation, accustomed to so different a mode of thought, fails to understand them? or that those who still think along the older lines fail also to see what the younger people mean by their strange phrases? The argument for theological restatement would appear to be

very strong, yet this need no more than in the case of science involve any disturbance of the "eternal verities" which lie behind.

As a first instance of the aid which science may give to religion let us consider a problem which is common to all religions and far older than Christianity—the old difficulty of "free will."

From the earliest recorded times, and doubtless long before, men have believed that human actions—their own and those of others—were to be attributed to the operation of individual choice and will. To question this at all is far from primitive—the naïve attitude appears rather to have been to interpret natural phenomena as due to the presence of personality and will in all sorts of objects in which we no longer find them. But, as the world was better understood, an underlying order and regularity came more and more to light, and philosophers came to believe that the course of events is determined, in one fashion or another, and to a great extent if not wholly, by some controlling power external to mankind.

This conclusion is as old as Homer. "Such was the fixed decree, and such the will of

Jove." With the advance of religious thought, when one God took the place of many gods, the conviction deepened, and theologians professed their faith in a divine control, complete and all-comprehending, under which the whole course of Nature and of human events has been decisively settled in detail before the beginning of the world.

What does this leave of human freedom? Are we mere clay in the hands of the Potter? And, if we are, does a shred of moral responsibility remain? or should it all be passed upon the head of the Power which fashioned us? These are hard questions indeed, and for centuries scholars have "found no end, in wandering mazes lost," while ordinary men, listening, have become puzzled and confused.

He would be bold indeed who claimed to solve this riddle of the ages; but science has certainly done much to clarify the statement of the problem, and, I believe, has greatly contributed toward a provisional solution.

In the first place, science has removed the contest from the field of dogmatic religion to that of general philosophy. So long as the predetermination of events was regarded as due to the immediate action of a Divine will,

everything depended upon the characteristics of the God in whom one believed, and one could believe in a God who, perhaps deliberately, left certain matters indeterminate, in human hands. But, with the growth of physical science, a new determinism, more rigid than the old, has arisen to take its place. One can no longer escape the problem by repudiating theology, nor even by accepting atheism.

I am sometimes moved to say that a century or so ago, as the age of Jonathan Edwards passed into that of Channing, thousands of good men cast those unwelcome tenants, Predestination and Original Sin, out of the back doors of their minds, bade them with execrations never to show their detested faces within their souls again, and settled down in a house swept and garnished.

But, as the century wears on, comes a knock at the front door of the same house—tenanted, it may be, by the next generation, but with life lived within it in the same way. A glance outside shows a visitor who must be treated with respect, whether by those who have banished the parson altogether, or by those who listen to different preaching from

of old—no less a personage than Dame Science. The door is thrown wide, and she is welcomed with all politeness into the best parlor, —but who are these two figures accompanying her? "Permit me to introduce my friends, Determinism and Heredity"—and, as in Lincoln's story, "there are those dam' fellers again!"

Belief in the determination of events by influences antecedent to the human will has indeed come back, fortified by a mass of evidence derived from the field of science and possessing its redoubtable authority. We can no longer escape determinism by changing from one school of religious belief to another, nor even by rejecting religion altogether. The fight must be fought out squarely on scientific ground.

In one field the battle is over, the enemy routed, and the gains consolidated. With respect to the whole vast realm of non-living Nature, all educated men agree in believing that everything that happens is determined by what happened just before—and so back and back, indefinitely. They are not only determinists, but are determinists of that thoroughgoing type which is called mechanis-

tic. For example, there will be an eclipse of the sun on January 24, 1925—two weeks from next Saturday. It will be total here in New Haven, and the sun will be obscured for just two minutes—from 9:12 to 9:14 a.m. This is a prediction—a prophecy—yet we astronomers are as certain that there will be an eclipse at that time and place as that there was one in California year before last, and our faith is a reasonable one. After a century or two of study, the laws governing the motions of the moon, earth and sun—that is, to be more precise, the rules which describe how these motions change from moment to moment,—are so accurately known that we can calculate in advance just where the three will be at any time; after which it is a matter of simple geometry to find just where and when the moon's shadow will fall upon the earth.

Here we have a typical illustration of complete mechanistic determinism; mechanistic, since it takes place in accordance with definite rules; "complete" because these rules are simple enough to be understood practically in full. It may seem strange to speak of the moon's motion as a simple problem, when my

distinguished colleague[1] who introduced me this evening has devoted some thirty years of his exceptional analytical talents to the perfecting of a solution already carried far by his predecessors. But a problem that can be solved by thirty years' work by a single investigator, however eminent, is really a very simple one, as Nature's problems go. Anyhow, whether we call it simple or not, we are agreed upon one thing. The eclipse happens because it *has to*. No sane man doubts that it will occur as predicted, and no one imagines any conscious action or volition in it. The moon does not obscure the sun to warn us of impending evil, or to oblige astronomers. It follows an invariable law, and pursues the path predestined from the foundation of the world. The great moving finger of shadow

> "writes, and having writ,
> Moves on; nor all your Piety nor Wit
> Shall lure it back to cancel half a line
> Nor all your Tears wash out a Word of it."

We can predict the time of the eclipse within a few seconds, and, if our predictions do not come exactly true, we are convinced that this

[1] Professor E. W. Brown.

is because we do not yet know all that can be found out regarding the motions of the earth, moon, and sun.[1]

But few of Nature's problems are as easy as the prediction of an eclipse. We astronomers, and millions more with us, are wondering, more or less anxiously, what the weather will be on the day of the eclipse, and here prediction is impracticable. We may say, on the basis of years of past observation, that the chances of clear sky here in Connecticut are nearly even; but what sort of weather we shall have on that fateful morning, and where it will be most favorable, we do not know.

Yet, here again, we are convinced that the processes of Nature are no less orderly, no less determinate, than in the eclipse itself—only vastly more complicated. The evaporation of water into the atmosphere, and its precipitation to form clouds, rain or snow, are physical processes, as definite as the motions of earth, moon, and sun, but involving,

[1] The eclipse actually happened about four seconds later than the predicted time. Professor Brown, after a careful study, has run down the cause of the discrepancy, attributing it mainly to the fact that, owing to internal changes, the rotation of the earth is not absolutely uniform, so that our reckoning of time, which depends on it, is thrown out a little.

not three bodies alone, but a vast multitude of circumstances—the varying temperatures of air and sea, the fluctuating winds, the interaction of innumerable factors. Though the laws which govern each step in this complex cycle may be, and doubtless are, as definite as that of gravitation, the system is so intricate that we cannot follow through its detailed behavior by exact mathematical analysis. Could we know the temperature, pressure, and motion of every portion of the earth's atmosphere, and of the waters of the sea, we might conceivably, by calculations far more intricate than those which predict the motion of the moon, predict the future course of the weather, even the number and size of the individual clouds; but both the initial data and the analytical treatment are far beyond our grasp. We must, in the present state of knowledge, be content with such empirical short-range predictions as are made daily by the Weather Bureau, and, though by no means infallible, are right for a large enough percentage of the time as to be of great practical value. It is noteworthy that such forecasts as can be made depend much less upon deduction from general physical theory than

on empirical conclusions from observation—a given situation, as regards the distribution of pressure and temperature over the country, being found to be usually followed by definite changes in these, and hence by weather of a specifiable type.

Our deterministic belief here begins to partake of the nature of faith; yet the weight of evidence that the separate stages of meteorological processes are actually subject to precise physical laws is so overwhelming, and the complexity of the details is so obvious, that our faith approaches full assurance, though our gift of prophecy is sadly imperfect.

The great majority of natural phenomena, of course, resemble the weather rather than the eclipse, as regards their intricacy, and the difficulty of prediction. Sometimes, as is often the case with earthquakes, we can anticipate the place, but not the time; sometimes, as with lightning, the time (when we have seen the clouds darkening) but not the place; sometimes we are still quite in the dark. Yet even here, we are still convinced that our helplessness arises from the complexity of the situation, or the inaccessibility of the data on which prediction might be based, and not

from any real lack of order or definiteness in the operations of Nature.

For example, the year 1910 was notable for the appearance of the two finest comets of modern times. One of these—Halley's Comet —was anticipated with great precision, the time of its return predicted to a day, and its place in the heavens foretold, so that it was detected while it still appeared as a faint speck of light even in the greatest telescopes. The other—which appeared in January and is known to astronomers as Comet 1910a—came as a complete surprise, and was first seen, not by any astronomer, but by three workmen on a South African railroad, whose duties called them to rise before the sun. This extraordinary difference, which led some of the unlettered to ridicule astronomical prediction, is very simply explicable. Halley's Comet has a period of about 76 years, and had been carefully observed at previous returns, and its orbit was accurately known. Comet 1910a has a period of many thousands of years and had never been seen before by civilized man; moreover, on its approach in that year its track was such as to keep it nearly behind the sun, and lost in the glare

of daylight, until it had grown so bright that a glance with the naked eye sufficed to reveal it. No educated man doubts that the orbits of the two are described under the same laws, and are equally, and completely, determinate.

With regard to the whole wide range of inorganic phenomena, therefore, we are all mechanists, believing in a fixed and rigid determination by antecedent circumstances. It need hardly be pointed out that this conclusion has little or no bearing on religion. Expressed in theological terms, our physical conclusions deal only with what McCosh called the "method of the divine government" and not at all with its existence.

When we pass to the realm of living things, we find the battle in full force, and the biological world divided into rival camps of mechanists and vitalists. The first maintain that organic as well as inorganic phenomena are parts of the same great whole, and similar in ultimate nature—the extreme complexity of structure in living matter accounting for its marvellous functional activities. The vitalists insist that no imaginable complexity of purely material structure can explain certain properties of the living organism, especially

in its embryonic development, and that some non-material factor must be present, which Driesch, the protagonist of this school, terms entelechy.

Upon the details of this argument a student of physical science is incompetent to pass. I may only say that, so far as I can learn from my biological friends, the mechanists appear to have the decided advantage, though the matter is not yet settled, and may be exceedingly difficult to settle beyond all question. It should be remembered, too, that Professor Driesch himself points out that the triumph of vitalism is not necessarily antagonistic to determinism; for it may well be that entelechy is subject to laws just as definite as those which govern matter and energy, so that, if we understood all these laws and could see through the complex web of circumstance, we might, even as vitalists, hope to predict all the behavior of the living animal, as definitely as we can now predict an eclipse.[1]

When we come to the field of psychology—to human consciousness and affairs—the opposing armies have hardly come fully to

[1] Quoted from memory from a lecture by Dr. Driesch at Princeton.

grips. One side claims that men, like animals, are in essence mechanistic systems, differing only in their extreme complexity, and that human conduct and thought, too, would be found by a complete analysis to be determined by physical antecedents. The other repudiates this altogether, and points to the chasm which separates matter from mind, and seems as impossible to bridge as ever it was. The mechanists return to the attack with an array of evidence upon the influence of matter, and in particular, of the brain, upon consciousness, which is very impressive—and so the contest goes on. We are not likely to live to see a decision—but what concerns us is the question. What are the stakes of the conflict? What do we stand to gain or lose if the mechanists win in this field, as they have already won in one, and bid fair to win in another?

At first thought, the issue appears to be of vast importance. Suppose that it were *proved* that human conduct and all human thoughts and emotions were predetermined, through a chain of inexorable sequences, by the physical state of the universe, before this world of ours began to be. Would we not then think of men as mere automata, and lose all belief in free-

dom, in responsibility, even in love and goodness? If so, the issue of the conflict is indeed vital for religion,—and none the less so for ethics, for government, for literature, for art, and for all human relations.

It is my firm conviction that this alarm arises from a misunderstanding of the real nature of the question, and that the complete victory of mechanistic determinism, if intelligently understood, would work no harm at all to religion, morality, government, or art, and would, indeed, have practically no bearing at all upon the ordinary relations of human life. This is a bold assertion, and on its face may seem incredible. Can we face the struggle with the doctrine of inexorable predestination with a detachment like that of the traditional frontierswoman, watching her husband engaged in a lively combat with a bear? "Go it, Paw! go it, bear! I never enjoyed a fight so much in my life; I don't care who wins!" Bear with me if, in support of my contention, I traverse ground which may be unfamiliar and seem rather difficult going to some of you.

My argument rests on two propositions; the first obvious, though sometimes neglected;

the second perhaps more familiar to the physicist than to the general public. First: Any satisfactory scientific theory must explain the properties which the objects of discussion actually have, and not attribute to them properties different from those which they possess. Second: The ultimate explanation of these properties may be so different from their superficial characteristics that it appears at first sight inconsistent with them.

The latter principle may be best illustrated by turning to the simpler fields of physics, where we have penetrated some way below the surface of the phenomena. Consider, for example, the steam in an engine cylinder. The mechanical engineer regards it as an invisible fluid, filling the whole space uniformly, compressible, capable of expansion, and exerting, upon the containing walls and piston, a pressure whose magnitude depends in a definite way upon the temperature and density of the gas. Upon these and similar properties of steam he bases his calculations, designs engines which work, measures their efficiency, and devises means for increasing it. Our whole mechanical civilization depends upon

the successful application of principles of this sort.

Yet the physicist who has studied the nature of gases tells us that not one of these engineering conceptions corresponds to the ultimate reality. The gas is not a continuous medium, filling the whole cylinder. It consists of an enormous multitude of tiny molecules, which occupy but a fraction of one per cent of the whole volume, and are in continuous and violent motion, colliding with one another, and with the containing walls, at unimaginably short intervals, only to rebound and continue their mad dance.

The molecules themselves are practically incompressible; when the gas is compressed or expanded, only the vacant space between them is diminished or increased.

The pressure, which seems at first to be the most obvious property of the steam, turns out to be a mere figment of the imagination. Pressure, by definition, is a force exerted uniformly over an area. What actually drives the piston is the impact upon it of countless flying molecules—each rebounding after delivering its own tiny blow. No two individual

molecular impacts are exactly the same, and, if our senses were fine enough, we could detect the irregularities. But, over the smallest measurable area, and during the least perceptible time, the number of these impacts is so extremely great that, though they are individually very unequal in amount, and very unevenly spaced, the sum total—their resultant—"averages up" to be the same (far within the possibility of measurement) over any given thousandth of a square inch for any thousandth of a second, as for any other equal area and time. The engineer, who is concerned with results, and not with ultimate origins, may therefore substitute the simple picture of the uniform and continually acting pressure for the desperately complicated chaos of molecular collisions, and get something that he can work with,—not roughly alone, but with an accuracy amply sufficient for the most precise measurements and computations. But it is not only to the engineer that the concept of pressure is of value. The physicist himself employs it in the greater part of his work, speaking of pressure, and introducing it into his equations, just as the engineer would do. He has learned the lesson

—so necessary to success in any serious activity—of forgetting those things which are irrelevant to the matter in hand. So, when it is not necessary for him to remember the billions on billions of molecular impacts,—when the simplified picture of a uniform pressure will describe their effects with abundant accuracy—he uses it without a qualm.

But he knows enough to trust this convenient image of "pressure" only over a limited range of conditions. When he deals with a gas so rarefied that the molecules have a good chance of flying clear across from wall to wall of the containing vessel without colliding with others on the way, he finds that the concepts of a continuous fluid and a uniform pressure break down entirely. For example, the pumps by means of which the last traces of air are removed from X-ray tubes, or from the tubes used in radio sets, capture the air molecules, one by one, by collision with the atoms in a moving stream of mercury vapor. These devices, which are of commercial as well as of scientific utility, depend essentially upon the negation of the ordinary idea of pressure. If the air and mercury vapor were really continuous fluids, exerting the same

pressure in all directions, these pumps would not work at all.

But if we should ask the physicist, "Is there *really* any such thing as a pressure?" he would weigh his words carefully before he replied. He would admit at once that pressure was not an *ultimate* property of matter,—it can be explained in terms of something very different, and clearly more fundamental. But what we are to call *real* is a more difficult question. Using the word in its everyday sense, he would be inclined to affirm that pressure "really" existed. At least, there actually is a property of those great aggregations of molecules which we call masses of liquid or gas, which can be described by the mathematical image of pressure,—not with rigorous exactness, to be sure, but, under all ordinary circumstances, with an approximation far greater than suffices for even the severest demands of scientific work. Such a property is called a "statistical property."

If some despiser of statistical properties should say, "But I refuse to call anything real that is not ultimate and rigorously precise," the physicist may answer, "Then show me anything physically real." The molecules,

whose motions, colliding and rebounding, suffice to account for the properties of the gas, are themselves not ultimate. Chemists have known for a century that they are composed of atoms in close combination. These atoms likewise are not ultimate,—modern physics has revealed them as complex systems, built up of a nucleus surrounded by numerous electrons,—and the nucleus itself is a structure, probably composed of electrons and of the "positive electrons" usually called protons. Are electrons and protons ultimate? It may be; but we cannot prove it, and even these tiniest constituents of matter, are beginning to show traces of properties, which demand structure for their explanation.[1]

We do not know that we have "struck bottom" when we come to the electron; indeed we do not know that there is any bottom to strike. It is conceivable that the smallest "elementary particles" so far known in nature may be structures composed of still smaller elements, that these again may be structures

[1] Spectroscopic research (in 1926, since these lectures were first delivered) makes it very probable that electrons behave like very rapidly rotating bodies—and are hence far from being mere dimensionless particles.

built up of constituents yet more minute, and so on *ad infinitum*. If this were true, the properties of electrons and protons by which we detect their existence would themselves be mere statistical properties, and the same would be true of all the properties of anything, however minute, and apparently fundamental, which could be detected by scientific investigation.

We need not, unless we choose, accept this hypothesis of infinite complexity. Anyone who does so gladly is of the spiritual kindred of the mathematicians. But, if we understand it even superficially, we shall realize that we have no guarantee whatever that anything known to science is ultimate.

All known properties of physical objects, except perhaps the properties of electrons and protons, are undoubtedly not ultimate, but are statistical properties, depending on the structure of these objects,—the way in which they are built up of their component parts. For practical purposes, therefore, it is the statistical properties which are important; and to call them unreal, and insist on confining our confidence exclusively to those ultimate properties which may not be acces-

sible at all to human investigation would be absurd.

The various statistical properties of matter, too, are not "on all fours." In the discussion of any given problem, some are important, and others irrelevant. The engineer, studying compressed air as a vehicle of power, regards it as a continuous gas, possessing a temperature, exerting a pressure, etc. The individual molecular kinetic energies or impacts which lie behind the pressure and temperature do not trouble him in the least; he does not need them in *his* business. It will only delay his work to recall such complexities, since the concepts of pressure and temperature describe those properties of the gas with which he has to do. The physicist, designing a modern vacuum pump, treats the gas he is pumping out as a swarm of molecules; but all that concerns him about the molecules themselves is that they rebound elastically when they strike one another or the containing walls. What their chemical composition may be does not concern him, for the present purpose, and he ignores it. The chemist is of course primarily concerned with these very questions of composition, and he regards the

molecules as composed of atoms, held together by "chemical affinity," and so achieved a century of steady progress while practically nothing was known of the nature of either atoms or affinity. The atomic physicist and spectroscopist of today sees those atoms as complicated structures of electrons, and chemical affinity, to him, is more and more clearly taking the form of recognizable electric or quantum forces.

Here, within the realm of physical science alone, we find four easily recognizable "levels of interpretation," even in dealing with gases, —the simplest known form of matter. The worker on each level can usually (though not always) afford to forget the properties and phenomena which belong to the lower (*i.e.*, more nearly ultimate) levels,—the engineer ignoring molecules, for example. On the other hand, he must eschew entirely thinking in terms of higher levels of interpretation. The spectroscopist can make no progress at all while he regards his gas as a continuous medium, or even his atoms as indivisible bodies.

Above all the student must take care not to confuse properties belonging to different levels. Temperature, for example, is essen-

tially a statistical property of a material body,—an extensive assemblage of atoms—being proportional to the *mean* kinetic energy of these atoms. A single atom or molecule cannot be said to have a temperature at all,—the conception simply does not apply to it.

The conceptions of statistical properties and levels of interpretation are of fundamental importance in my argument. Since they are not likely to be familiar to those who are not conversant with modern scientific work, they have been explained in considerable detail, and the illustrations have been taken from the physical sciences. This has been done partly because the mechanistic hypothesis is undisputed in this field, and partly because the relations involved are relatively simple. When we pass to the biological sciences, the complexity increases tremendously, and new and higher levels of interpretation appear. Hundreds, nay, thousands, of atoms may be built into a single molecule of protein. The smallest sub-structure within a cell which is visible with the microscope must contain many thousands of these giant molecules, or a correspondingly greater number of smaller ones,

and many such sub-structures are observable in a single living cell.

Consider how, in the more complex living things, millions of cells are present in a single organ, and how all the organs of the body form one organism, interacting in ways which science is still in the process of discovering, and it is clear that there is room enough for a whole hierarchy of levels, one above another, each with its own concepts and terminology. At the top we come to the psychological level—or it may be levels—exhibited in some lower degree, and to a debatable extent, in the higher animals, and in what we are sometimes pleased to call "perfection" in mankind.

The detailed understanding of the way in which each level is built up on a foundation of the statistical properties of those below it, which is found in physics, here gives place to much scantier knowledge, in which some of the gaps are so wide that there is still great difference of opinion whether any real bridge across them, of the sort here discussed, exists at all. We are concerned at present, however, not with these controversies, but with the question, What is the bearing on religion and

life of the assumption that the gaps can be bridged, and that a continuous chain of physical relationships reaches right up to the psychological level?

One conclusion can be drawn at once, and decisively. Any deduction of human psychology directly from its ultimate physical bases (if, as here assumed, these exist) is entirely beyond human power.

Suppose that every thought, emotion, or volition of a man depends entirely upon the configurations of the atoms and electrons in his brain and body. Suppose, too, that we had full and detailed knowledge of every stage of the process. We might then, imaginably, if we were given the positions and motions of all the electrons and protons in his body (and in his environment!) at a given instant, deduce the thoughts and desires of his heart at that moment. Moreover, carrying our analysis backward and forward in time, with the aid of known physical laws, we might work out also, and precisely, the man's whole past history and future earthly destiny—body and mind alike. The solution of some vast equation would tell the whole story.

Such is the postulate of the mechanistic

theory of human conduct, but the word "mechanistic" is unfortunate, for it makes us think of a machine,—of something which works in a manner which we can follow,—of cog-wheels and cams and levers, in some complicated arrangement. How complicated is the human machine, or the equation which might be imagined to represent it? No ordinary mode of description is adequate to the answer. The best which my imagination can do is to picture the equation written out upon a huge square sheet, for the perusal, not of mere men, but of beings of incomparably more than human intelligence and powers of reasoning. I am moved to call these beings "archangels,"—not with any theological significance, but simply because the word conveys the idea of an intellectually superior being better than any other that I know of. To avoid misunderstanding, let us call them mathematical archangels. By hypothesis, a mathematical archangel can pass along the sheet on which the great equation is written, with the velocity of light, reading everything as he goes along and storing it in his memory, as easily as we can read the successive letters of a word.

The two archangels start from the upper corner of the sheet, one to read the first line, the other to count the remaining lines in which it is written. It will take the first archangel, travelling with the speed of light, *sixty billion years* to read the first line, and the other as long a time to count the lines which remain for the first one to read![1] And this terrific complexity represents only the *statement* of the problem,—not its solution,—and ignores entirely the influence of other men or

[1] This extraordinary conclusion rests upon a simple reckoning which is worth giving in full. One gram of matter contains 6.1×10^{23} electrons, and an equal number of protons (assuming, as appears very probable, that the atomic nuclei are built up of these constituents). Taking the weight of an average man as 75 kilograms (7.5×10^4 grams) the whole number of protons and electrons in his body is $2 \times 6.1 \times 10^{23} \times 7.5 \times 10^4$, or 9×10^{28}, approximately. The great equation must contain a term representing the interaction of each of these particles with every other,—that is, if n is the number of particles it will have $\frac{1}{2}n(n-1)$ terms, or, in this case 4×10^{57}. If each term occupies one square centimeter of the sheet (which is very little to allow, as it involves all three of the coördinates of each particle) the sheet would be about 6×10^{28} cm. square. The distance which light travels in one year is 9.5×10^{17} cm. so that the sheet would be 6×10^{10} light-years square.

All the numerical data on which this calculation is based are known within much less than one per cent of their values, except the estimated weight of the man. On account of the uncertainty of this, only one significant figure is given in the result.

of the rest of his environment, upon the man in question!

There is no need to say more. Any human attempt to understand men must be based, not on their ultimate nature, if indeed electrons are ultimate, but on their *proximate* nature, upon those characteristics of the human mind and body which belong to the highest levels of interpretation, and are learned empirically, by observation, and not deductively, from an analysis of their relations to the phenomena of lower levels.

Granting all this, have we yet reached the heart of the difficulty? No matter how many levels we have to deal with, how can rigid, exact, physical predetermination of the motion of every electron and proton, at the bottom, come out at the top as responsible action? Can the predetermined become the unpredictable? Can perfect bondage end in freedom?

One of these questions,—the next to the last, and by far the simplest,—appears to be answerable without leaving the realm of pure physics.

The simplest of all natural processes which may be directly observed by the human senses, even when aided by instrumental

means, is probably the so-called "Brownian movement" of minute particles suspended in a liquid or a gas. When such particles are viewed with a powerful microscope, it is found that they are never at rest, but in incessant motion—oscillating and dancing irregularly, and progressing slowly through the field of view, though quite at random, and with no tendency toward a fixed direction.

There is far more in this motion than the casual onlooker might imagine. When we watch it, we are seeing deeper down into the arcana of nature than our eyes can reach in any other way. The "eternal flux" of Democritus is going on visibly before us. For we have here the true perpetual motion,—frictionless, unexhausted, and endless. These tiny specks dance about under the impact upon them of the molecules of the liquid or the gas which surrounds them. For particles of any considerable size, the net effect of the molecular impacts on one side averages out to be practically exactly the same as on the other; but for the smallest, the "averaging out," though nearly complete, is not exactly so, and the remaining small unbalanced excess of force, acting on so small a mass, produces a

motion great enough to be visible under the microscope—ever changing in direction and amount, as the impacts change, but never coming to an end.

This motion is the simplest observable phenomenon in nature, for it depends directly upon molecular impacts, and belongs to the molecular level of interpretation. No more perfect example of strict determinism (according to our present interpretation of nature) could be desired.

> The ball no question makes of ayes or noes
> But here or there, as strikes the player, goes.

Yet the Brownian movement is, in a very real sense, altogether unpredictable. We might watch a given particle under the microscope for an hour—or a year—and we would be no nearer than before to being able to foretell whether, during the next second, it would move to the north, south, east or west, or whether the amount of its displacement would be great or small. The motion is absolutely at random, and quite independent of the history of the preceding movement. Strange as it may seem, this is a direct consequence of theory. The motion is unpredict-

able and apparently arbitrary *just because* it is rigidly determinate—in a particular way.

In this case the ball is struck, not by one player, but by innumerable myriads at once. The slightest visible motion in the shortest perceptible interval of time results from the combined influence of billions of molecular collisions. We cannot see and follow the motions of the individual molecules, and even if we could, we could not compute the combined effect of the blows which rain upon the particle in a thousandth of a second without months or years of labor. To calculate in advance the next motion which the particle will make is therefore doubly impossible, from the practical standpoint. Ultimate determination, by the complexity of the process, is transformed into apparent uncertainty, of such a nature as to serve as the very definition of random motion. The determinate *is* the unpredictable, in this simplest of all known instances.

Yet the Brownian movement, though thus utterly unpredictable in detail, is still predictable *on the average*. Should we follow a single particle, and observe its displacements in

ten thousand successive seconds, we should find that the average motion per second, for each of the successive groups of a thousand observations, was very nearly the same. Though the directions of the individual motions appeared arbitrary, we would find almost the same number, out of the ten thousand, directed toward any one of the thirty-two points of the compass as toward any other. Going farther, we should find that the percentages of cases in which the individual motions were more than twice the average, less than half, and so on, were substantially the same for each group of a thousand observations. The theory of probability, applied to the present case, leads to conclusions agreeing exactly with these observed relations, and enables predictions of a more recondite sort. For example, if we divide our ten thousand observations into groups of a hundred,—"random samples,"—and take the mean for each, the theory predicts not only that these mean values will be nearly the same, but by what average amount they will deviate from precise equality.

The Brownian movement, therefore, is predictable statistically, but not individually;

and it is not alone in this respect. If we ask, for example, whether any given person will commit suicide, or die of the measles, in the year 1927, no certain answer can be given; but if it is inquired how many persons in the city of New York will do either of these things in 1927, a fairly good prediction of the number is possible on the basis of past experience. The student of statistics will expect to find fluctuations from year to year in the number of deaths from either of these causes per million of population, and will apply to these fluctuations mathematical formulae of exactly the same type which he would apply to the Brownian movement. If the fluctuations seriously exceed those that might be anticipated from "random sampling" he will be convinced that some real cause of change has been at work, and will seek diligently to find it,—and usually succeed.

Now contracting the measles is a pretty good example of an involuntary organic experience, and suicide of a voluntary act; yet both follow very similar statistical laws to those which govern the typically inorganic Brownian movement. Is this a mere accidental coin-

cidence? May it not be that, in dealing with living organisms and human conduct, we are still in contact with statistical properties? In the case of systems as ineffably complicated as even the simplest bacteria,—let alone men,—we might expect to find statistical properties of the most varied sorts, some of which were apparently quite different in kind from the physical relations which underlay them, deep down. Whether these could rise to the height of the psychological characteristics of mankind, and whether, in fact, they do, are unsettled questions. The extreme complexity of the problem makes the attainment of a detailed physical solution appear exceedingly remote, if possible at all. On the other hand, a positive proof that factors of an essentially different nature are certainly operative in human action appears to be equally remote. The question for or against the mechanistic hypothesis must remain unsettled,—a matter of opinion, not of proof.

This would not be so if we could find actual, unquestionable examples of the much-discussed metaphysically free choice. But, as I understand it, this would mean that we must find human actions which are entirely inde-

pendent of *all* antecedent conditions except the arbitrary will of the actor,—not merely uninfluenced by all external and environmental factors, but by the past experience, conscious and subconscious, and the present character of the man himself.

I, for one, have never quite succeeded in imagining just how such an action could certainly be recognized if it happened in one's own experience,—much less in the conduct of others. But I am not here to argue in favor of the mechanistic side of the question,—though, as a matter of personal opinion, I believe in it strongly. What I have to discuss is the consequences of the assumption—if only for the sake of argument—that human characteristics and conduct are ultimately explicable in terms of physical science alone.

We have already seen that, if we knew all the details of the connection, human actions would none the less be *practically* quite unpredictable from the physical data. But, as a matter of fact, we all know that human actions *are* predictable to a very considerable degree. Take, for example, a game of football. One might, if time permitted, give an elaborate behavioristic description of the

twenty-two erect, bipedal organisms, differentiated into two equal groups by apparently removable integuments of different color-patterns, which performed various motions and gyrations upon a level rectangle some hundred meters in length, in connection with a prolate spheroid of major axis about thirty centimeters. The tropisms of these organisms might be described, their remarkable polarity, and its reversal when the gyrations were renewed after short periods of repose,—also the remarkable inhibitions occurring upon the production of a shrill sound by an auxiliary organism, after which the violent motility of the principal organisms instantaneously ceased.

But one could go on with such descriptions for hour after hour, and convey far less understanding of the phenomena than is transmitted by the simple statement that two groups of conscious and intelligent men are engaged in a game, in which the object is to advance the ball in accordance with certain definite rules. To the spectator who knows the rules thoroughly every play has an intelligible meaning; and a great deal of prediction is possible. Some of it is of a general

sort; for example, the probability that a player, having legitimate possession of the ball, and an unobstructed chance to run, will touch it down behind his own goal-line is exceedingly small. Once in a hundred thousand games some poor chap might go temporarily insane and do such a thing,—but it isn't likely. Specific predictions, such as which of the contending teams will win the game, are quite impossible to one who knows the rules, but nothing at all of the teams. When the latter knowledge is added, prediction often approaches certainty.

This trivial instance serves as well as a graver one might do to illustrate my point, which is, that, with the aid of certain hypotheses about human beings and their relations, such as the one regarding the football players which was sketched, rather than formulated in detail, a moment ago, it is possible to predict large classes of human actions with a statistical percentage of success which is often practically complete, and is in any case very remarkable, considering the known complexity of the phenomena.

Though the prediction never approaches the extreme precision of the Nautical Al-

manac, it is often very much better than that of the Weather Bureau, and it increases in accuracy with the extent of previous knowledge of the characteristics of the individuals concerned. These descriptions of human characteristics in psychological terms are not merely useful, but indispensable. No other even roughly satisfactory way of describing human relationships has yet been devised.

What would become of all these concepts in the face of a completely developed mechanistic theory? We must think not of some human formulation of the theory, but of that which might be attained by the abler class of mathematical archangels. Well, I pointed out already, some time ago, that any theory must describe the characteristics of its subject-matter as they are, and not otherwise,—and, if a satisfactory theory, must account for them fully.

An ideal mechanistic theory of mankind must therefore not only predict what all human actions would be, but explain just why the familiar psychological conceptions of men enable so much useful prediction to be made, and also why these predictions will not always come out right. After what has already been

said, it is clear that this implies that the said psychological properties must appear as statistical properties (in some generalized sense) deducible from the perfected theory.

Now to anyone familiar with statistical properties, these psychological characteristics show a good many familiar earmarks. The images under which we conceive of them look extremely different from the ultimate mechanism which by hypothesis lies behind them; but this is true (*mutatis mutandis*) of temperature and pressure. The predictions which they enable us to make have very different percentages of success in different cases; and this is likewise true of the more complicated cases of physical prediction from statistical properties.

Finally, many of these psychological properties are fully exhibited only within a certain field, and gradually lose their applicability outside it.

This is conspicuously true of the very concept of freedom—with its correlative, responsibility. Absolute metaphysical freedom, if it did exist, would make human action, so far as it appeared therein, altogether unpredictable. What we ordinarily mean by the "freedom of

the will," as I understand it, appears to be very much better described by a current political tag,—"self-determination." We hold a man responsible, and therefore "free," when, analyzing the antecedents of his action as thoroughly as we can, we find among the intelligible antecedents only such as are internal to the man,—interpretable on the psychological level as arising in and from his own personality. When our analysis shows the presence of external factors, our estimate of his responsibility is diminished.

In an extreme case it vanishes. We do not hold a man who has fallen out of an aircraft responsible for any damage he may do to a person or thing on which he lands,—his trajectory is too obviously determined by circumstances beyond his control. But there are all sorts of intermediate cases. For example, when we realize that the internal factors are not in normal relation—as in the imbecile or insane—our assessment of the degree of responsibility and of freedom is greatly altered. It would not be very difficult to find a series of cases showing a gradual transition from full freedom and responsibility to their complete absence, and match it with a simi-

larly gradual diminution of the applicability of the conception of pressure in a gas.

A science perfectly developed, not by men but by archangels, might then find that all the characteristics which we are accustomed to regard as the fundamental properties of mind and character were not ultimate, but were, by some superlative exercise of a glorified mathematics, interpretable statistically, level above level, in quite different ultimate—or at least penultimate—terms. But what of it, so long as the characteristics themselves, on their own level, are described and interpreted in the same manner as before?

Here we are at last at the heart of the issue, and I do not think I can express my argument better than by means of another somewhat fantastic illustration.

Suppose—as we are doing throughout, to see what follows—that a mechanistic theory of human actions and character, satisfying the severest possible tests, whether by men or archangels, is possible, so that "mechanistic men" *can* exist. Suppose, too, to bring out the distinction, that the ordinary human beings who *do* exist are not completely mechanistic, but have entelechies or souls or what-

not which are outside the mechanistically predetermined order of things; and suppose, finally, that the Creator, for reasons sufficient to Himself, creates mechanistic men and women, in considerable numbers, and introduces them into the world already peopled by the others.

By our very hypothesis, these mechanistic people must, in all their properties and characteristics, be entirely similar to other people. They must look like them, act like them, and show not only the same physical and racial types, but the same qualities of intellect, taste, feeling, affection, morals, and religion. They must be subject to the same accidents and diseases—neither more nor less. They must reason with the same logic—or lack of it—and a due proportion of them must go insane—and insane in human fashion. If, in any one of these particulars, or in any other way whatever, the two sets of men are systematically and definitely different and distinguishable, this means that our first hypothesis is erroneous, and that the mechanistic model on which the new creations were designed is imperfect and scientifically unsatisfactory. But, if it is satisfactory—that

is, if the mechanistic hypothesis is supposed to be true—there will be no such discriminating points, and the mechanistic and non-mechanistic humans will be altogether indistinguishable. The mechanistic men will not be conscious of any difference between themselves and the others; neither will the others; the archangels will be able to discern no difference, and only an omniscient God will be able to tell which is which!

There is only one defect in this picture; a mechanistic man and a non-mechanistic woman must be just as able to marry and raise a family of children as any other pair; but the question to which class these children will belong baffles my imaginative powers.

All this may seem merely a grotesque fantasy; but it represents, seriously and fairly, what is really involved in the assumption that a mechanistic theory of humanity *might* be scientifically satisfactory. Nothing short of it will suffice.

I believe that a great deal of the difficulty which is felt concerning this question arises from the assumption, made more or less unconsciously by both the friends and foes of determinism, that a "mechanistic man" must

be so mechanical that he cannot be really human,—which is simply the assumption that a satisfactory mechanistic theory is impossible of achievement.

If such a theory really could be developed, it would have to predict the characteristics of mankind *as they actually are*. This is really the whole story. The question is not whether we are "free" and possess the familiar characteristics of mankind or are "automatic" and do not really possess them at all. It is rather one of the theoretical interpretation of the nature of these characteristics. Are they ultimate, being, even in the last analysis, no other than they appear to be on the surface? Or are they, like practically everything else we know in Nature, characteristics belonging to a certain level of interpretation, valid, and simply and immediately appropriate, when applied to relations upon this level, but susceptible of analysis—hypothetically, at least, and through inconceivable complexities,—in terms of underlying relations on lower levels? They are important, anyhow,—is this because they go far down into the nature of things, or because they are in such intimate touch with our

own lives? So long as they themselves are the same, what does it matter? Nothing.

This, then, is my conclusion. The triumph or the failure of the mechanistic theory would alike leave the whole science and art of the relations of man to man,—indeed, all relations which are interpreted on the psychological level—quite untouched. There is nothing at all to fear.

Some minor matters might, indeed, be affected—and clarified—by such fuller understanding of the problem as is accessible to human investigation. As an illustration, not only psychiatrists, but the intelligent public, are coming to realize that certain desires and impulses, which occasionally emerge into consciousness, and startle or shock us by their crudity, are not temptations from external powers of evil, but evidences of our animal nature. The new interpretation does not counsel yielding to these lower impulses, but our greater knowledge gives us better ways of dealing with them, and turning the energy into useful instead of destructive channels, and here, as always, knowledge helps and does not harm.

One more hypothetical objector may per-

haps deserve to be met,—his argument being, "But, after all, if things are ultimately determinate, is not our conviction of freedom, even if carefully defined and limited, an illusion?" Here, I believe, the new determinism of physical forces leaves us in a much better position to answer than the older theological formulation. So long as the determining factor in all events was regarded as being the *direct* action of a Divine will, essentially similar to our own, this difficulty would hardly down. But modern determinism leaves freedom and responsibility just as "real' as pressure and temperature; nay, as all those things which are ordinarily taken as examples of external reality.

We talk of sunrise, but it is not the sun that moves. We speak of mountains as "firm" and "everlasting"; yet we know that they have been upheaved from the depths, and will wear away under the gnawing rain; but they nevertheless afford us secure foundations for our puny works. We call rock solid,—and so it is, not only to wall our own bodies in, but to bar out single atoms, or ordinary light. Yet the student of atomic structure or of X-rays sees this same rock as an assemblage of iso-

lated particles, separated by distances which are as great in comparison with their own dimensions as the spaces which divide the planets from one another. All but one part in a million millions of its bulk is blank emptiness. Which is the illusion here, and which the reality?

This much at least we may say. If our personal freedom and responsibility are illusions, so is the blue sky above us and the solid earth beneath our feet. Let the keen analyst pursue his unending search for the elusive ultimate; we rest upon the proximate. Our freedom is, at the least, as sure as sunrise, as solid as rock, as immovable as the everlasting hills; and need we ask more?

II.

GOD AND MAN

GOD AND MAN

IN my first lecture I tried to give, in summary fashion, some account of the mechanistic interpretation of nature,—depending in part upon the results of physical science, and in part on a generalization of these results. Accepting this theory as a working hypothesis—though admitting fully that it is by no means conclusively established outside the realm of the inorganic—I attempted to show that such acceptance was without practical bearing upon the great problem of the reality of human responsibility and "freedom," which lies at the very base of any theory of human relations.

The central point of my argument was that in our scientific study of nature we begin by discussing groups of related phenomena in terms suggested by the phenomena themselves, and appropriate to their description—that is, on a special and relevant "level of interpretation." Later, we may succeed in interpreting the concepts and laws of a given level as properties of complex systems of ob-

jects belonging to a "lower" or more fundamental level. Such success usually improves and clarifies our understanding of the concepts belonging to the original level and informs us where, and in what manner, they cease to be applicable; but it does not enable us to dispense with them, nor make them illusory. For discussion of relations belonging to the original level, they still remain valid and eminently useful. In fact, in practically all the problems of life, and perhaps in all accessible problems of science itself, we never come at all into direct contact with ultimate physical reality, and the *proximate* properties and nature of the things with which we deal are of more concern to us than the ultimate.

From considerations of this type, I concluded that a complete acceptance of the mechanistic theory leaves intact our practical faith in freedom, though perhaps altering a little our conception of its ultimate nature and exact limits.

What does it do to our faith in God? What sort of God, if any, can a convinced mechanist believe in? and what, too, will be his conception of the nature of man?

It is to these topics, or, rather, to a few

salient points connected with them, that our attention may now be addressed.

A theistic—or, for that matter, an atheistic—conclusion, must evidently be based not on the proximate qualities of things, but on the closest approach that we can make to their ultimate nature.

The conception of this ultimate nature, so far as it is accessible to the researches of science, which is afforded by the mechanistic theory, is quite definite. All the observable properties of things and men are statistical, interpretable in terms of structures, built out of elements whose own properties are again statistically explicable by their structure, and so on—till we come to a base level, the lowest we can reach. The elements belonging to this level are enormously numerous, but of very few kinds (only two kinds remaining on the lowest level now known) and their properties are few and simple. If the properties were either numerous or complicated (as is the case with the atoms of the chemist) we would suspect at once that a lower level existed, and was accessible to investigation. The goal of the mechanistic research—its final triumph—would be the interpretation of all the phe-

nomena of Nature in terms of structures built up of fundamental elements which had absolutely no individuality and no properties at all, except that they satisfied certain simple laws.[1] Electrons and protons come near this, but are not quite satisfactory. Why, for example, should a proton have 1847 times the mass of an electron? When—and if—this question is answered, it will presumably be by some theory which goes down to a still deeper level, and derives this number from some combination of simple numerical and geometrical constants,—that is, from abstract mathematical considerations.

In general, so long as the elements of the lowest accessible level have any properties which we cannot thus derive, the thoroughgoing mechanist will not be satisfied.

But, if his dream comes true, a strange thing happens. The actual properties of Nature will then all be deducible statistically from those of systems composed of the ultimate elements, concerning which *all* that we need to know, is that they move according to

[1] And perhaps also a continuous medium like Maxwell's "ether," which likewise satisfies simple mathematical laws.

specified mathematical laws. This is indeed all that we *can* know about such elements, for, by our very hypothesis, their positions and motions alone suffice for the interpretation of all physical phenomena. Their own nature, apart from positions and motions, remains inaccessible to investigation. They are, in fact, exactly similar to the "undefined elements" of the modern mathematician.

A present-day geometer will tell you that we have no intuitive knowledge of the properties of a point, a line, or a plane—indeed, we must begin our serious study of geometry by clearing our minds of any such preconceived notions, and proceed to derive all that we can determine of the properties of points, lines, or planes, *solely* from those relations between them which we adopt as our initial postulates—(which were once called axioms). Except for the postulates, and the relations which can logically be deduced from them, points, lines and planes are not defined at all. Indeed, by adopting different sets of postulates, all sorts of geometrical systems can be set up, each one logical and self-consistent, but many of them very strange to the uninitiated—such as the "finite geometry" in

which each line contains three points and no more. What sort of geometry we shall have depends entirely upon what set of initial relations are postulated.

Similarly, the complete success of physical science would leave us with no knowledge at all of the ultimate nature of the material universe, except that certain mathematical relations—of the nature of differential equations, or something more intricate—were satisfied. Knowledge of these relations alone would enable a "mathematical archangel" to work out the whole structure and history of the universe—and, what is more, of all other possible universes, in which the ultimate particles were different in number or arrangement. To distinguish the actual universe, it would be only necessary to specify what the arrangement and motion of the particles was at one moment,—or, in mathematical terms, to specify the values of the numerical constants which appear in the general solution of the differential equations.

In the same fashion, but far more simply, knowledge of the law of gravitation enables the mathematician to show that the orbits of all planets in any possible system must satisfy

Kepler's laws. The solar system may then be specified by the numerical constants which define the orbits of its planets, and its past and future history becomes calculable.

Going back to the greater problem, we are led to the conclusion that the whole past and future of the material universe—and of beasts and men, if they, too, are mechanistic, —is contained implicitly, but fully and in exact detail, in a system of abstract mathematical equations, which moreover contain also the history of all other possible universes. Beyond these relations even the archangels need not, and cannot go, so far as concerns science—for science answers only the question "*How* do these things come to pass?" And this question has by hypotheses been answered in full. She has shot her bolt, and brought down the quarry. Her task is ended.

But philosophy, metaphysics, asks another question—the question which the child asks first of all, "*Why* are things so?"—and we find ourselves at once on the frontier of a new realm, where judgments of value take a leading place, and the methods of mathematical analysis are no longer of prime importance.

So far as I can see, there are two answers to the question. Why is there any universe at all? Is there anything back of it? Is there any reason for it?

One is that there is nothing back of it all, —or at least, nothing concerning which we may profitably attempt any sort of reasoning whatever. The other (which I purposely state in vague and general terms) is that the universe exists because of the existence of some Power behind it.

Between these two postulates we must choose on the basis of our judgments of value. Here again the situation is seen most clearly from the scientific point of view. If there is nothing behind the universe, outside the realm of science, then the whole order of nature is reducible to abstract mathematical relationships which exist in an absolute vacuum—physical and metaphysical alike,—for no intelligible reason at all. To paraphrase the trivial song

> They're here because
> They're here because
> They're here because they're here

and that is all!

I confess freely that this postulate appears to me to be a very difficult one to hold. So long as atoms, with their decidedly individual and unexplained characteristics, were supposed to be ultimate, it was not so hard to think of them as simply existing, without any assignable reason, as real things. Much more, so long as human personality is regarded as ultimate, it is easy to think of men as simply existing, as real people. But if atoms and men alike are to be dissolved into special portions of a particular solution of a system of differential equations,[1] we have to think, instead, or at least to try to think, of self-existent differential equations,—which is pretty hard work. And when it comes to believing that the real reason for things, the true cause and source of all the splendid universe which surrounds us, and of our very selves, is entirely to be found in the self-existence of these abstract mathematical relations, —well, my personal judgment of values pronounces in the negative, and I believe that most men's would do so too.

Far rather would I accept the alternative

[1] Or, very probably, equations of greater mathematical complexity.

that these relations, and hence the universe, exist because there is a Power behind them.

The question may be put in another way. In any event, we must base our interpretation of the universe upon something—some reality—and use some sort of descriptive image of this in our reasoning. The image of a set of mathematical relations has proved to be highly useful and successful in dealing with physical phenomena, and might, if we knew enough, prove equally so in dealing with biological and psychological phenomena, too, when the interpretation of these was also carried down, stage by stage, to the lowest level. On these lower levels of interpretation, the image of this Reality in terms of mathematical relations,—or, to go a level or two higher, of what men of letters often call "blind force," is sufficient. But can we be sure that this is invariably true. Is it the *only* image that it is profitable to employ on any level?

In particular, we human beings have relations with one another which we can intelligibly describe only by using terms belonging to the psychological level. We can assuredly have relations of some sort with the Cosmic Power—we can at least realize its existence,

admire the splendor of its operations, and adjust our own conduct in view of what we know of its workings. Shall we, in all this, image to ourselves this Power *only* as "blind force"? Is there nothing within it that is interpretable on the higher levels—although there is certainly that within men which is so interpretable?

If we answer "Nothing," we must admit that the stream has risen higher than its source, that in details of a particular instance of the manifestation of this Power, something has appeared that surpasses the Power itself. Here again, my judgment of values speaks decisively, and on the other side.

For this reason, then, I find that, starting with a strictly mechanistic view of nature, I am led to the conception of a Power behind nature which contains characteristics expressible on the level of consciousness and personality, as well as those descriptible in terms of matter and energy. To call this power God is then natural and inevitable.

But we must not stop here. We humans cannot succeed,—or, at least, have not succeeded,—in imagining levels of interpretation higher than that of our own conscious-

ness and psychology, and we cannot, therefore, pitch on a higher plane even our images of God himself. What more striking instance of this is there, indeed, than is afforded by the very pronoun, where we

> must use a speech so poor
> It narrows the Supreme with sex,

if we desire to avoid the use of words which connote impersonality and unconsciousness?

There may be, somewhere in the universe, beings belonging to the same mechanistically based natural order, but higher in the scale, who can reach up to levels to which we cannot. However this may be, the same argument which has already been used would lead to the conclusion that the "God of Nature" possesses, not only characteristics interpretable on the highest human level, but on any and all higher levels that have been reached by any product of evolution in all the universe, or that might in future be reached, whether in this universe or in any other based upon the same physical laws.

This is a lofty image indeed; but is it more than a mere phantasm of the imagination? What reason have we, after all, for fancying

that beings higher in the scale than ourselves may exist, now or in the future, in this our universe?

Once again, the mechanistic interpretation of the universe gives a definite answer—as, indeed, does any naturalistic explanation, however agreeable to the vitalist, which accepts the principle of evolution. The whole trend of scientific evidence, in any event, goes to convince us that our species is no exception to the great sequence, but a part of the evolutionary series. Of the details of our origin we know little; but of one thing there can be no doubt. The human species, from the geological point of view, is extremely recent. Creatures who could be called human at all have probably existed, at most, for less than one of the thousand or so millions of years during which life has tenanted the earth. When it comes to those qualities which make the race *humane*,—even imperfectly,—we find evidence of notable progress, not merely in the few thousands of years covered by recorded history, but even within the last few centuries.

In this post-war period of disillusion, there may be those who greet the last statement

with doubt; but I dare to appeal to the very history of the Great War itself in support of my theories. The inhumanities of this war—for example, those perpetrated by the Central Powers which finally forced our long-delaying country into the conflict—were bad enough, God knows. But compare them with the far greater horrors of the Thirty Years' War, and compare the reaction of the civilized world in the two cases. Consider that men of the same race and nation were involved in either case, and that no fundamental change—and, indeed, surprisingly little alteration—had taken place in religious dogmas and standards from one century to the other; and even in this instance, so justly regarded as a dishonor to our modern civilization, the advance in three centuries is manifest.

This development is highly advantageous to it, and in such progress we see evolution in process almost under our eyes. It goes on so rapidly, among the relatively labile qualities of the mind, that the characteristics of the body—inevitably much more stable in a slow-breeding species—seem annoyingly unalterable.

Whether the changes occupy generations or millennia, they are, from the geological standpoint, so rapid that they might almost be called abrupt. Our species is one of the very newest, and its most distinctive characteristics are still in the very act of rapid development.

Now these humane qualities are such as—despite our natural bias in the matter—we are clearly justified in regarding as of primary importance. It is not without cause that we set ourselves apart in thought from the "beasts that perish." Making the fullest reasonable allowance for such rudimentary intellectual or moral characteristics as the higher animals *may* possess, there is a great gulf fixed between us and them,—one which appears comparable only to that which separates the organic and inorganic. It is by a very natural metaphor that we speak of mankind as possessing a "life of the spirit" which is not present in anything else on earth.

Go now to any student of evolution, and ask him concerning the appearance of new characteristics—new capabilities. Do they appear suddenly in complete form—as Minerva, in the myth, sprang from the head of

Jupiter? We need not be experts to answer. Everyone knows that all the evidence indicates that such capabilities first appear in a very rudimentary form, and that the interval between this first appearance and their complete development—from the first light-sensitive spots to full-blown eyes, from pseudopodia and cilia to limbs and wings—is not to be measured in years and centuries, but in geological epochs.

From the evolutionary viewpoint, therefore, mankind are far from appearing as the final and perfect flower of creation. We have just emerged into a new realm, and there is every reason to suppose that our higher capacities are of a very rudimentary sort, in comparison with those which a purely naturalistic evolution might—and indeed may—produce in the fullness of time. The life of the spirit is within us, but it may reasonably be compared with the life of the body when this was new upon the earth. We are spiritually alive, but we are spiritual *protozoa*—low in organization, deficient in the powers of life, and above all, probably very lacking in sensitivity to impulses and relations belonging to the new and higher level.

The worst of it is, that a lot of us appear to be not merely protozoa, but pathogenic!

Is this a counsel of despair? Far from it; such a thought can arise only in minds steeped in delusions of grandeur. The life of the spirit—the search for truth, the love of beauty, the hunger after justice and righteousness—is really ours. It may be that there exist beings whose appreciation of beauty or goodness surpasses ours as far as did the intellectual powers of the fantastic mathematical archangels to whom I introduced you; but this is certainly not a horrible or a revolting idea.

We have no evidence of the existence of such beings. This may be because they do not exist, or because they are remote from us in the depths of space—or perhaps, because our protozoan spiritual senses—or lack of them —fail to perceive their existence.

There is not much value in speculations of this sort; but it is decidedly useful for us, who are so exceedingly prone to racial, if not to individual conceit, to realize that the picture of our relative unimportance in the realm of higher things which is painted by science far outdoes that drawn by old-fash-

ioned piety. When the godly Dr. Watts wrote

> Great God, how infinite art Thou
> What worthless worms are we,

he was paying our race an unintended compliment, and one grotesquely exaggerated; for a worm is a highly organized animal, with well-developed senses and powers of locomotion, and very far above the protozoan stage of evolution. But even if, to make an analogy accurate, we must describe ourselves as lower than worms, this is no reason for shame or discouragement.

> Honor and shame from no condition rise.
> Act well thy part; there all the honor lies.

And acting our part well is not beyond the powers of our nature.

More than one conclusion follows from this belief in our spiritually protozoan nature. The first is that there is very little danger that we may pitch our conception of God too high. The farthest reach of our imaginative powers is not at all likely to construct an image of the Power whence all things come which shall be greater, or nobler, or more perfect than that Power itself. Our ideas of God may err by defect, but hardly by excess. We

may generalize freely, on the basis of what Nature gives us at the start, without a fear that we may picture something greater than God.

At the outset our natural theology gives us a good deal to go on. For example, our "God of Nature" must be entirely one God, and altogether at harmony within himself. No one can believe this more firmly than the mechanist, who is convinced that all nature is a single, vast, orderly system.

To the physically-minded man there is little appeal in the conception of a limited and incomplete God, realizing himself through struggle and evolution. Such an idea may furnish the vitalist a faith to live by. But he who divines beneath the turmoil of the struggle for life, and the advance of evolution, the unfailing operation of invariant laws, will fix his faith on that which lies deeper than these, and believe that the strife and confusion belong upon some proximate and derivative level, but the order and harmony to the ultimate nature of things, and the Power behind them.

Again, no one feels more keenly than the student of Nature the greatness and splendor

of that Power,—though here, too, our minds often fail to make the leap. We can comprehend the glory of Nature only in fragments. The "star-sown void of space" baffles our imagination, though not our geometry,—and talk of millions aids us but little. It is to lesser things—to the mountains and the sea—that we must turn if we are to be instinctively moved to a realization of their vastness and our littleness.

Yet knowledge comes to the aid of sense. When one stands upon the rim of the Grand Canyon, the first impression is that of the dizzy depth below. Then the inexperienced listen, perhaps with wonder, to statistics of distances and heights. The trained eye needs no such aid,—it sees a gulf so vast that the clear blue of the sky comes down into it and changes the colors of the farther side. Then the mind recalls—or, it may be, picks out bit by bit for itself—the history of the past, and sees where the very roots of mountains, worn down to a featureless plain, have been buried beneath the sea,—raised again with thousands of feet of new rocks covering them and tilted up into new mountains; worn to a plain once more, buried deep, raised a third time

and worn away; and to the sense of vastness in space is added a far more overwhelming sense of vastness in time, and human life takes a different proportion in the scheme of things.

But the vastness is only the beginning—the least of the marvels. More bewildering, though less widely known, is the complexity of even the simplest things. A snowflake falls upon the ground, and melts in the twinkling of an eye. What has happened—one event or many? We know that the molecules of water have broken loose from their orderly crystalline arrangement, one by one, and slid away to form the liquid. It is a demonstrable fact that the number of separate molecular events which are involved in the melting of a small snowflake far exceeds the total number of bodily movements,—heartbeats and all,—which were made by all the soldiers of the Great War during its whole four years' duration[1]—and a hundred such snowflakes must

[1] This deserves a proof. The number of molecules in one gram of water is 3.3×10^{22}; in a small snowflake of 0.1 milligrams, 3.3×10^{18}. If there were 20 million soldiers in the War, and each made 10 movements per second for four years, the total number of movements would be $2 \times 10^{7} \times 10 \times 1.26 \times 10^{8}$ or 2.5×10^{16}—less than one per cent of the number of molecules.

go to make every drop of the water which swells the flooded rivers.

Before such complexity the mind reels,—and we would despair, did we not see through all the vastness and intricacy a universal and perfect order.

Those who have spent their lives in the study of some one phase of this order, hoping to unveil a little more of it, have an overwhelming sense of its magnificence, which I despair of conveying to you, even did time permit. Suffice it to say that once it is perceived, the order is more impressive by far than the vastness and intricacy together. It is unescapable, and, as we look through Nature to the Power behind, we understand Pippa's hymn;—

> Say not a small event; why small?
> Cost it more pain that this, ye call
> A great event, should come to pass
> Than that? Untwine me from the mass
> Of deeds that make up life, one deed
> Power shall fall short in, or exceed.

Natural theology passes now into a very real natural religion—a conviction that the ways of this Power are heaven-high above our own,

and that acceptance of them—submission, if you will, to the order revealed in Nature—is the part of wisdom and honor no less than of prudence.

We dare not dream with Omar—splendid as is his revolt—of shattering the scheme of things to bits and remolding it nearer to our hearts' desire—for we have some glimmerings of knowledge what would be shattered, and what the remolding would cost. Rather would we turn to a new meaning Henley's noble song of patriotism.

> Ever the faith endures
> England, my England,
> Take and break us; we are yours,
> England, my own.
> Life is sweet, and joy runs high
> Between English earth and sky.
> Death is death; but we will die
> To the song on your bugles blown.

Yes, though we knew but the order of Nature alone, we would have that which compelled reverence and commanded loyalty. Our personal hopes and dreams are not greater nor nobler than this august and splendid universe. We may apply our knowledge of its laws to the great benefit of us and ours; but it

is better that we should perish than that these laws should be altered for our benefit. Even though our image of the Power behind it all be impersonal, we may feel this; and if we do not restrict our thinking so unduly, we will find ourselves saying with Job,

> Though He slay me, yet will I trust in Him.

Here, our language goes beyond that of a religion based solely on that part of Nature which lies without ourselves, and our thought may well follow, and better precede it. I have already explained my reasons for believing in a personal God,—a Being within whose nature is that which is interpretable in the terms of the level on which our personal relations are described, and must be so interpreted if we are to consider profitably our relations with Him. We are still in the realm of natural religion, but by this time our protozoan limitations begin to become unpleasantly manifest. It is altogether probable that God is fully as much superior to our personalities in intellectual capacity and in moral excellence as the physical universe exceeds our bodies in extent and age and power. Our intellects assent; but our imaginations

find it hard indeed to fly so high. Newly emerged, and with our spiritual sense but dull, we must depend mainly upon the stronger wings of the reason. This is indeed usually our experience at the frontiers—it is the reason, not the imagination, which gives us some conception of the depths of space and time; while farther afield, in the geometry of four or more dimensions, the imagination fails altogether, while the analytical faculty pursues an untroubled way.

Is it possible that here our reasoning powers are a little less primitively protozoan than our imagination? However that may be, it is the reason that enables us to generalize our idea of God, and come at last to the conception of a transcendent Deity,—clear outside those limitations of space and time within which the material universe, and we as parts of it, have our being; and equally free from those intellectual and moral limitations which hem us in, but of whose very existence we are hardly conscious,—a Being who is the only reason *why* there is any universe, but who incomparably excels all that the universe manifests of Him. Now we are aiming high indeed, but not too high; yet it is hard for

us to realize the significance of what we are saying. "Such knowledge is too wonderful for me; it is high. I cannot attain unto it."

Our more formal statements find themselves expressed in negative terms—"infinite, eternal, and unchangeable." Some positive conceptions, indeed, we may form—"omniscience" may bring before us the idea of a God to whom all the intricate happenings in the universe, in all their manifold relations, are immediately and luminously present in consciousness without effort,—not by a laborious process, as we might imagine an archangel to work them out, but directly, as our own minds are conscious of simple and elementary relations. To such a God, the whole net of consequences of any change in the conditions in the universe—the whole vast set of contingencies which might arise from all possible arrangements of its parts—would be as immediately obvious as are the direct consequences of a single move at chess to an experienced player.

Some such glimpses of the meaning of Divinity in the intellectual sphere, our imagination can give us; but when it comes to the realm of character and goodness, we falter,

and find ourselves employing almost instinctively the language of poetry—language which, as Mathew Arnold says, is "thrown out" at ideas almost beyond our reach. "Who is like unto Thee, O Lord . . . glorious in holiness, fearful in praises, doing wonders?"

Yet, even here, the religion of aspiration and the religion of reason are very near together. What is to me the greatest of all these flashes of inspired expression is in the English Prayer-Book—"Whose service is perfect freedom." What is this—feeling or reason? poetry or fact? It is worth recalling that it is different from the Latin of the prayer which suggested it. That ran *quem servire est regnare*, and went back to the old parable of service—to a good master, but involuntary—faithfully performed, and rewarded with emancipation and subordinate authority. But the newer words—born in the days of struggle that bought our freedom—speak not of privilege but of liberty. Can we understand it better than by going back once more to natural religion? "*Natura non nisi parendo vincitur.*" We cannot shatter the scheme of things and mold our hearts' desire out of the ruins, but if we study the scheme patiently,

accept it fully, and shape our dreams and our efforts according to it, we have, for ourselves and our race, not only many things which our fathers desired in vain, but others of which they did not even dream. By obeying we have not lost, but won.

And is not the other phrase just the restatement of the same truth in the language of personal and moral experience? "God's service" is not the subordination of ourselves to some external arbitrary commands—alien, though very wise,—it is no slavish obedience, but the acceptance of those laws, written in Nature—in our own being as well as in that of the Power beyond,—which we must understand and follow if we are to realize our own nobler possibilities. And this service is freedom. It is sadly true that much which has been claimed as such service has been bondage; but still more sadly true that there are many false gods,—or false images of God.

But in the True God's service the freedom does not come as a future reward,—whether as an unmerited bounty or as something ultimately to be earned—it is there all along. His service *is* perfect freedom—the two are identical. One may take this as his definition of

freedom if he will; I prefer to make it a part of my definition of God.

We may now turn to consider, briefly and in an inevitably sketchy fashion, the bearings of these conceptions of God and man upon certain problems of religion.

Greatest among these is the ancient mystery of evil and suffering. He would be a bold man indeed who claimed a solution of this riddle of the ages. The utmost that one may hope for is that some light may be thrown into the darkness; and, I believe, it may be fairly claimed that the change in our attitude which has come with science has alleviated, though of course not removed, the great difficulty.

To begin with, there is no room in the scheme which we have been following for the least dualism. We must face things squarely. The only credible God is one who is responsible—to use our absurdly inadequate human word—for the entire universe. Nor can we assume that the division—the conflict—which we find so acute in the moral realm runs up into the nature of God, without going flatly counter to the whole trend of what we know of that part of the universe which we are best

able to study. A God not at unity within himself is as incredible as one who has "made" only a part of things. And it is hardly necessary to argue that this unity must be one of good and not of evil. Serene calm has never, so far as I know, been assigned as an attribute of the Devil.

But, if God is good, why is there so much suffering and mischief among men? The first partial answer that can be given is as old as Job, and has never been so superbly stated as in the great answer out of the whirlwind, when God, beginning with questions so unanswerable that his hearers hardly recognized their meaning, comes down, little by little, from the heavens to the earth, from the earth to the inhabitants thereof, till his simple-minded hearers, who knew nothing of what it meant to "guide Arcturus" but found their image of irresistible power in the fiercer and stronger beasts, realized that the ways of God are past finding out.

In the language of our day, all that we can find out in Nature is but a very small part of a very great whole. Newton, when he compared himself to a child picking up pebbles on the seashore, with the whole ocean before

him, spoke not with exaggerated and fantastic humility, but with real knowledge and discernment. We may, if we will, take refuge in the belief in our own protozoan powers, and conclude that the problem, though not inherently insoluble, may be so for us, with our inevitable limitations.

But we must go as far as we can, and the evolutionary conception of life helps us on. It is entirely credible—and, I believe, may be regarded as very probable—that the intensity of the moral struggle in which we are fighting for our very souls is attendant upon our racial state of emergence into the moral realm. We may not be the only beings in that realm, and, viewed from a point of larger vantage, our condition of stress may be peculiar to our emergence. We need not read our own troubles into Nature, and assume that war and pain are everywhere.

But, though this limits the problem, it does not solve it. Why should we be hurt so much? Why should not the world have been made so that wrong choices were impossible? or, at least, so that stupidity and malignity did incomparably less mischief than they do here?

To the first of these questions I would an-

swer, in the vernacular, by remarking that what these objectors appear to want is a "fool-proof" world—intellectually and morally—and how a fool-proof world could be inhabited—(or desired)—by any one but a fool, I fail to comprehend.

In more serious vein, I find it impossible to conceive of freedom—by which I mean the practical freedom I spoke of in my last lecture—which shall not involve at least the possibility of going wrong intellectually, and doing wrong morally—and creatures devoid of this freedom would not be human.

The second question, from Job's day almost to our own, was the hardest of all. With Dr. Holmes, we may all feel that the problem why so much suffering should exist—and so much of it by those who are altogether innocent—is the most perplexing that disturbs the mind.

But in these latter days a new doubt springs up. We see the evils about us and question who—or what—is to blame. For ages past it has been clear that the blame for some rests upon ourselves,—individually or collectively. No one can possibly claim now that the evils of slavery are inherent in the

nature of things, and not in the remediable defects of mankind; for these evils are hardly to be spoken of save in the past tense. War is, alas, still only too perennially present; but however we may differ as to the wisest and most effective ways of diminishing and ultimately abolishing it, no one supposes that all such efforts are inherently doomed, by their very nature, to failure.

But there are all other evils,—and terrible ones,—which for centuries were reasonably enough regarded as resulting from "acts of God," and not "of the King's enemies"—calamities in which man was an impotent and helpless sufferer. Chief among these are the ancient trinity of terrors,—earthquake, famine, and pestilence. Two life-times, or at most three, take us back to the times when for these there was no remedy;—but how is it today?

Famine, in normal times, is quite banished; the antidote may be expressed in a single word—transportation. Only in backward and primitive communities does the ordinary machinery of commerce, aided by what has come to be in truth *common* humanity, undergo any strain in coping with the situation. In abnormal times, when organized destruction

has taken the place of organized production, we have seen famine take a ghastly toll; but this is a secondary effect. Famine, as a primary scourge of mankind, is dead.

Pestilence, too, is no longer an unopposed tyrant. After one or two isolated, but decisive, successes in an earlier time, the last half-century has seen the war carried into the enemy's country. The nature of almost all the destructive infections is known; preventive measures, often extremely effective, are practicable against almost all of them, and curative treatment in many cases, while in a few the disease is almost exterminated.

One need not be old to recall the days when, in our own country, yellow fever was an appalling scourge against which only the coming of winter brought any hope of relief, after thousands had perished in a single city. Now the disease has been practically banished from the civilized world, and is so sharply restricted to a few localities that there is reasonable hope that it may be annihilated.

We grow so used to such things, in this age of wonders, that we forget what marvels they really are. Once I realized it. A missionary, in the University chapel at Princeton, was in

the midst of an account of work for the lepers of India, and had chosen for his text, most naturally, some verse from the story of Naaman the Syrian. Quite incidentally, in the course of his talk, he referred to the work of English physicians in India, and Americans in the Philippines, which, though unfinished, gave great promise of finding means to arrest, if not actually to cure, the disease in many cases. Hardly a ripple of interest showed in his audience—we had heard of it before, and perhaps said to ourselves, "Chaulmoogra oil":—but there flashed into my mind, out of the Biblical story, the words of the King of Israel, "Am I God, to kill and to make alive, that this man doth send unto me to recover a man of his leprosy?" So far has the conquest of Nature through obedience brought us in a single lifetime.

But the earth quakes as of old, and when it does "the inhabitants thereof are as grasshoppers." We have no hope of preventing earthquakes, or of diminishing their violence in the least; nor can we foretell, except occasionally, and in the roughest way (within a decade or so) when they will happen. Yet we are not helpless beneath the scourge. We

know fairly well why they happen, and, what is more important, where to anticipate their occurrence. Still more, we know how to build structures which will be immune to even heavy shocks. Appalling disasters have happened within the memory of us all; but they need not happen again. When, in a crowded city, built on the very edge of a fault-line renowned for its seismic activity, thousands of people live in tall houses with thick walls of rubble masonry, and when a destructive shock comes before dawn, the loss of life horrifies us —but the responsibility can hardly be fairly ascribed to the Designer of the universe. Should the city be rebuilt in the old perilous fashion, there is no doubt where the blame would belong. But this has not happened at Messina, and need not happen anywhere. It cannot be claimed, of course, that all the ills wherewith the face of the earth is blackened are equally capable of prevention or avoidance by human effort,—in our present state of human knowledge. But our gain is still rapid, and much more ground will assuredly be won before the advance slackens.

This has put altogether a new aspect on Job's great problem. Mr. Wells, in one of the

most striking of his works[1] has staged the ancient drama in modern dress; and, at the climax, when his hero, hearing as in a dream a Voice from afar, protests against the evil and suffering with which life is filled, the Voice replies, "Which of all the things whereof you complain dare you tell me it is beyond the power of man to remedy?" This is not the voice of antiquity; no man would have put this claim even into the mouth of God a century ago; but it is hard to gainsay now. May it not be,—are we not indeed urged by the very course of nature to believe,—that the responsibility for the continuance of these ills is ours? "It was our fault, and our very great fault, and not the judgment of Heaven"—and where malice has slain its thousands, ignorance has slain its tens of thousands.

The evil and misery in the world appear then, not as a sentence of doom, but as a challenge to quit ourselves like men, and put them down. In a word, we are on the moral firing line of the universe. The fight is heavy and we cannot escape unscarred. Life under such conditions is not altogether pleasant—

[1] *The Undying Fire.*

neither was it so in the trenches—but it is worth living. If indeed the moral struggle is more intense in mankind than elsewhere, we have a post of honor, as well as one of danger. We are here to do our bit, and may do it in the faith that we are fighting in no forlorn hope, that, from the beginning, and in the very nature of things, the obedience that conquers, and the service that is freedom, are the sufficient means of ultimate victory.

Let us pass now to quite another problem —one in which the theoretical and practical sides of religion meet—the question of prayer. Prayer is common to practically all forms of religion—but is it reasonable? What is the sense in praying, if all things are immutably predetermined—whether by the mechanism of Nature or the will of God?

This question is asked often enough; and perhaps the most striking thing about it is the extremely limited and primitive view of religion and of prayer that usually shows through it. Prayer, I suppose, may be roughly defined as the conscious presentation of any phase of our thoughts or interests to God's attention—to use a trivial but fairly expressive word. So understood, prayer in-

cludes such elements as adoration—recognition of the magnificence of God; thanksgiving—recognition of our utter dependence upon Him, and our indebtedness to Him; confession of sin—recognition of our own failures and defects,—and petition—requests for benefits which we may desire. All those elements may be found in the prayers of any liturgy—that is, in those which, by the survival of the fittest, have been judged profitable for widespread use. One alone among them usurps popular attention, and this is the last, the only one that may contain a selfish element.

That prayer and petition should be synonymous in so many minds is a sad comment on the general state of religious discernment; but, when it comes to the consideration of intellectual difficulties, petition is the only phase of prayer which raises them.

At first sight these difficulties appear very serious, but upon analysis they turn out to be relatively unimportant. God Almighty is the only being to whom we can attribute complete metaphysical freedom, or whom, at least, we may suppose to be conditioned only by His own nature, and not by anything ex-

ternal to Himself—and the only one whom we may believe to have a complete and perfect understanding of our own words and thoughts. When this is realized, it appears that it is more obviously reasonable to pray to God for some specific thing than to make the most trivial request of our neighbor, for in the later case the whole problem of the nature of human freedom of choice and action comes in.

But, if this is granted, the difficulty remains that we have reason to believe that the Divine design of the universe has already been determined, "before the beginning of years"—and that the future follows inevitably upon the past—and what prayer can alter that which has happened already? This might be an insuperable difficulty if we did not believe in a transcendent God—outside our limitations of time, as well as of space—but, with this belief the complication vanishes; for on God's side of the matter our distinctions of before and after are not inevitable—indeed, not present at all.

But this idea is pretty well over our heads, and we may perhaps do better with a cruder and more anthropomorphic one. We may

imagine the Deity as if He were a craftsman, contemplating the creation of a universe, and choosing that design which seemed to Him best. To His unbounded intellect, the whole set of consequences of any design would be fully and obviously present. Hence, in considering the design of a universe in which men in general, and you and I in particular, would be present, He would perceive fully just what characteristics each one of us would possess, foresee our every thought and wish—and, in estimating the relative merit of different plans for the universe, according to which we might fare differently, He would give our every desire—vocal or unexpressed—exactly that due and equitable degree of weight in estimating the total advantage of the plan, which each inherently deserved.

This image of God is crude in many ways, and I beg that you will not suppose me to believe that the physical universe had a definite beginning in time, by special creation, or that the eternal God chooses in our fashion between alternatives; but I believe that it is a profitable image, *ad hoc*, to remove this particular unreal difficulty.

Practically, then, we may imagine the sig-

nificance of petitionary prayer as if each one of us who prays stood for the moment by the side of God in the beginning, just before the Creation, and asked, "O Lord, please make the universe so that this thing that I want will happen." This makes petition entirely reasonable—and at the same time a rather serious matter. But I do not think that it discourages prayer about minor things—not if we believe in a God

> To whom this world is neither small nor great,
> Who knew beforehand every plan we planned.

When, how much, and for what we should pray, and what things we should leave to God's consideration without asking specially for it, this picture does not tell us. Religious experience—the unfailing experimental test, —must be our guide. But it is worth noting that our analysis excludes only such requests as we believe to be incongruous with what we knew of the Divine scheme of things. No one would pray for an eclipse—it is a little too much like asking to shatter the scheme of things—and we may well remember the last couplet of Hartley Coleridge's great sonnet:

> But if for any wish thou dar'st not pray
> Then pray to God to take that wish away.

So far we have considered only natural religion—the conclusion to which one might come by a rational process, based on the data of experience. But is it credible that there may be revealed religion? May God have communicated religious truth to men by more direct means? To assume that God *could not* do so would be to put a severe limitation upon His capabilities, for which there appears no reason. Whether God *would* actually do so, and *has* done so, is another question.

There are systems enough and to spare that claim such Divine inspiration—indeed, a religion that did not do so would belong to a small and unusual group. The conflicting claims of the various prophets cannot all be true. How may we test them?

In the first place, it may be assumed that a genuine religious revelation, if such existed, would prove reasonable; it should be capable of logical discussion, and be found internally consistent—though full discussion might be very hard work. Moreover, we would expect —and demand—that any such revelation should be consistent with the known facts of nature,—physical, organic, and psychological,—and should not insist upon complex in-

terpretations of phenomena already simply explainable. Saint Augustine realized this perfectly well, and acted on it, when, in the course of his searchings after truth, he rejected one popular religion because it invoked an intricate demonology to explain eclipses—which he knew could be predicted by simple principles of geometry.

Again,—and most important of all—a genuine religious revelation must have important, indeed, exceptional, influences for good upon life and character; and—which is perhaps not so fully realized—we have a right to expect that it shall appeal not to some limited type of humanity, but to men and women of all races and all temperaments.

Finally, judging by the analogy of nature, we may expect a revelation of general principles, leaving it to mankind to work out their logical and formal expression, and their practical applications, rather than a detailed system of revealed theoretical propositions. A thousand years ago—perhaps only two centuries ago—the opposite alternative might have seemed more probable. But our present knowledge of the "method of the divine government" in nature makes it entirely clear

that we are not provided with inspired—or intuitive—information in detail regarding the laws of motion, or of health, but instead are given access to the facts from which it is possible for us, and incumbent upon us, to derive the detailed knowledge ourselves, by a process of steadily improving approximation.

If this holds true also in the religious sphere it is not to be anticipated that a genuine and specific religious revelation will contain, as an integral part of itself, an exact and perfect theology, but rather that it should afford the basis on which, by human effort, a theological system may be built, changing in detail as time goes on, but increasing in its approximation to the truth.

Meanwhile, in the sphere of conduct—which rarely depends much upon the refinements of theoretical interpretation—the underlying religious truth may do its work for good effectively from the start. Changes in theological theory may occur,—and may be expected to continue to happen. But even though, from some standpoints, they might be fairly regarded as fundamental, we may anticipate that these changes would make very little change in the practice of religion

—in our convictions regarding the right conduct of life.

We have just seen an excellent example of this in the realm of physics. The theory of relativity demands such radical and revolutionary changes in our conceptions of space and time that, for some time after its promulgation, physicists were divided into opposing camps, which might with considerable accuracy have been called "fundamentalist" and "modernist" if these words had emerged into popular theological controversy a few years earlier. Many features of the psychology of the adherents of both sides of the physical controversy were, indeed, amusingly similar to those which have been exhibited in the theological dispute. Yet, all the time, the practice of engineering—which, in most of its branches, is substantially applied physics—went on serenely, without the least disturbance. The foundations were shaken, nay, have been radically altered, but the superstructure stands undisturbed. The simple reason is that the fundamental changes did not alter those derivative rules upon which engineering practice—and indeed, most of theoretical physics—is based; or, if it changed them at all, it did

so to so small a degree that it made no practical difference whether one worked on the old basis or on the new.

Science has advanced so fast in the last half-century that many men have seen more than one such fundamental change. One of the older chemists of my acquaintance tells me that he has lived through *four* successive complete alterations of the "fundamentals" —but he is as enthusiastic a lover of chemistry as ever, and his analytical practice has been modified mainly by a more complete understanding of what was really happening in the reactions which he still uses for his tests.

The man trained in science, especially in physical science, if he is interested in religion, is not likely to be nearly as much alarmed as most other folks are at the spectacle of such a time of theological differences as the present. He is used to crises of this sort—indeed, his own technical field shows now-a-days not a succession of crises separated by intervals of readjustment, but a continuous crisis, with one change crowding close upon the last,— and he regards this not as an alarming time of doubt, but as an exhilarating one of rapid advance. Even so, he has no particular love

of new theories because they are new. He has seen too many new theories launched which proved to be decidedly less meritorious than the old ones which they sought to replace. He is human, and may therefore love an old theory because it is old—especially if it is much easier to understand than the new one. But his scientific conscience demands that he test all theories by comparison with the existing evidence, reject those which conflict with it, and hold his mind open, both in cases where the matter is doubtful, and in those more interesting instances when two very different theories both fit the evidence satisfactorily.

This training makes him very suspicious of the proposition that certain statements of theological theory—or even of religious truth—possess absolute, plenary, inspired accuracy. For such a claim he demands demonstrative evidence. Yet, the very same statements, regarded as attempts to formulate the truth, may appeal to him as admirable. In some instances he may regard them as being the most successful formulations of the principle which are yet known; in others, as permissible, but alternative, formulations, when two or more ways of regarding the same reli-

gious matter appear both to be consistent with the known evidence, but to be valuable in practice to people of different temperaments.

In many other cases he will believe that the old statements need revision; but a restatement, meeting the present evidence, is usually practicable, and he will proceed on this, not worried by having had to change, nor by the fear that he may have to do so again.

One or two specific illustrations of this may be appropriate. A Christian man of scientific training has no business to be greatly disturbed over questions regarding Biblical inspiration. The old belief in the inerrancy of the text in every detail no longer appeals to him as either tenable or important; but this will not lessen his conviction of the immense religious value of the Bible. On the contrary, he will be set free to realize it.

One example must suffice us—the tale of Adam and Eve, whose real and present significance has been almost completely obscured by the discussion of such things as the fate of Adam's rib, or the inheritance of Adam's sin, so that we fail to realize its quality as the classic and incomparable parable of sophistication and the mischief which it works. The

Serpent is with us still, and his advice is very much what it always was—"Try everything once."

Yet, if the training of the student of science has done its work, he will not exalt his own conclusions into a new standard of infallibility, and will recognize that those who see less—or more—of precise and detailed accuracy in the Biblical record than he does have also something to say for themselves. Many matters of critical interpretation must remain open, for lack of evidence upon which to settle them, and in many other cases different students, equally impartial, may regard the weight of evidence differently.

But what must the Christian of scientific training do with the numerous miracles which are narrated in both the Old Testament and the New? In some cases the traditional meaning of the narrative is doubtful; for example, my scholarly and very conservative friend, Professor R. D. Wilson of Princeton Theological Seminary, has concluded from a careful linguistic study that what Joshua is recorded as having said to the sun,—literally, "Be silent,"—is not correctly translated as "Stand thou still" (cease moving), but should

be interpreted, "Be darkened" (cease shining); and this converts the story of a physical miracle of a most extraordinary sort into the account of a natural phenomenon of scientific interest—one of the earliest observations of a total solar eclipse. But many stories remain which, if they are historic at all, describe occurrences which are inconsistent with those recurrent and apparently invariant, regularities in Nature, which we call its laws.

Two types of theological interpretation of such events are possible. One attributes them to the direct interposition of an arbitrary—that is, unconditioned—Divine Will; the other, to the orderly interaction with the familiar world of something, or some person, belonging to a realm of existence which does not ordinarily come into contact with the physical universe in which we "live and move and have our being." The former interpretation runs counter to the conception of the universe—and, what is more, of God—which the study of Nature has led us to entertain. But this is not true of the latter. All that this demands is the belief that there may exist within the universe, in its larger meaning,

realms which do not ordinarily come into touch with our cosmos,—our complex of matter and energy,—but which may conceivably do so—the familiar and unfamiliar realms and their potential interaction being all, and equally, governed by law.

No one can disprove this hypothesis, in the nature of the case. All that can be claimed by the negative is that no sufficient evidence of such exceptional interactions is forthcoming, and in its absence, an attitude of pure intellectual agnosticism concerning such realms is necessary.

The question of the credibility of any miraculous tale resolves itself, therefore, into these.

First. What is the evidence, from the standpoint of literary and historical criticism, for the authenticity and reliability of the record of the alleged miracle?

Second. Is there any independent reason, metaphysical, religious, or otherwise, for supposing that any of the persons, places, or things concerned in it may have had some connection with some realm, external to the material universe, such as has been suggested above?

On both these questions the judgments of good and honest men—nay, of devout men—may differ widely. Every case must be handled separately, and the crudest error which can be made is to say that "to deny one is to deny all."

The miraculous element, especially in the Gospels, appears to me to be of much less importance than the enthusiasts among either its defenders or its opponents would claim. On the positive side—apart entirely from all critical questions regarding the narratives—there are the repeated utterances of Christ himself concerning "signs and wonders," in which He invariably treated them as wholly subordinate to His moral and religious teaching, and spoke of belief based on miracles with something almost like contempt. On the negative side the denial of all the miracles *in toto* (certainly a very drastic process) though it plays havoc with belief in the inerrancy of the record, and the plenary inspiration of church councils in later centuries to affirm historic propositions, leaves the character and teaching of Jesus intact—and makes surprisingly little difference in matters of practical religion.

It seems to me that the emphasis, in discussing the Gospels, should be laid altogether elsewhere—upon the character and teaching of the Founder of Christianity. At the least, there is something here which is far more remarkable, and vastly more important, than the wonder-stories which accompany it.

Modern faith in miracles—and there is plenty of it left—depends very little on detailed arguments as to the standing of the records as a matter of history, and very much upon conclusions regarding Jesus Christ. It is not primary, but derivative, and follows from the conviction that a spiritual world transcending that of our ordinary life exists, and that He belonged to it. Exceptional—miraculous—phenomena might be expected to happen in such an event. Even so, the narratives do not stand and fall together, and it is worthy of note that the "greater" miracles are not necessarily the least credible. The moral and religious, more than the physical, bearing of the story is what comes. For example, the tales of the stilling of the storm on Gennesaret, and of the raising of Lazarus, offer really, from this point of view, less difficulty than the incident of the barren

fig-tree,—though the latter does not demand for its explanations anything more than a purely natural (or providential) coincidence.[1] But, in all cases, the religious principles which the story illustrates, be it parable or miracle, are of far more importance than the exceptional character of the recorded happening.

Finally let us consider for a few moments the momentous question what, or who, Jesus Christ was. It may be relevant to point out that He himself chose this question as one exceedingly difficult to answer when—turning the tables upon the Pharisees, who had badgered Him with entangling questions, He asked, "What think ye of Christ; whose Son is he."

A man of science can contribute but little toward the solution, for our present answer must depend mainly on the recorded acts and teachings of Jesus, and the study of these

[1] I may add that, to me, the latter story appears entirely credible. Not all the stupid criticisms come from the orthodox; witness the objections to the fig-tree episode on the basis that Christ should have respected private property, and that it was unjust to demand figs when "the time of figs was not yet." To any one who knows how fig-trees grow wild in the East, and how the unripe fruit is visible months beforehand, these objections are very amusing.

raises critical questions regarding the records, which must be discussed by scholars in an altogether different discipline,—and regarding which I, at least, have no authority at all to speak.

One does not need critical training of this sort, though, to perceive the extraordinary quality of the teaching of the Gospels. What appeals to me personally most of all is the amazing, and almost incredible, translocation of Jesus' sense of values, as compared with our ordinary one. Take, for example, his apparent indifference to the whole matter of economic advantage, or even welfare, in which He differs as widely from the socialist as from the plutocrat. There is something unearthly about it. I can only describe the impression it produces by recalling Browning's great description of Lazarus, after all his sense of earthly values had been altered by his glimpse of heavenly things.

It is things like this that have what Matthew Arnold—certainly no incompetent critic, nor biased by orthodoxy—called the "authentic stamp of Jesus." They must have come from Him, not from the devoted but blunder-

ing followers who often imperfectly understood Him.

Now, among the sayings of Jesus recorded in the Gospels, right among the teachings that have this authentic stamp, and intimately connected with them, are found most extraordinary claims—for example, that He was to be the final judge of all mankind, dispensing to each individual a righteous judgment according to his works.

The great majority of students of Christian theology—that is, of men who have striven to construct a systematic theory regarding the data presented, in anything but a systematic way, in the Christian "source-material"—have come to the conclusion that these claims could be interpreted only as evidences of insanity on the one hand, or of divinity on the other, and have dismissed the former as vastly the less credible alternative. This is of course a very familiar argument—one of the commonplaces of apologetics—and I speak of it here only to lead up to what follows.

This and other arguments convinced Christian people, from the apostles onward, that Jesus was Divine—God manifest on earth.

Following this lead, they expressed this conviction in explicit form, developing the doctrine of the Trinity, and ascribing to God the Son all the characteristics and attributes of the Eternal Father. "Such as is the Father, is the Son" is the final word of Catholic theology—and the Protestant reformation did not alter this in the least. "These three are one God, the same in substance, and equal in power and glory" is the voice of Puritanism in Cromwell's day.

Yet, in the very Gospels which Catholic and Protestant alike recognize as possessing absolute authority are recorded sayings of Jesus such as these. "Of that day and hour knoweth no man,—neither the Son, but the Father." "My Father is greater than I." "As the Father has life in himself, so hath he given to the Son to have life in himself"—and this is far from an exhaustive list.

These sayings appear to disclaim specifically the equality and omniscience which are predicated of Jesus by the creeds and confessions; indeed, the last seems to be a direct attribution of inherent and essential immortality to the Father only. I think that it must be fairly admitted that these sayings are not

reconcilable with the formal and specific statements of the creeds. The framers of these formulae had not the easy escape of questioning the authenticity of the troublesome statements—they appear to have ignored them tacitly. Were they to blame for this, and if so, how much? It may surprise you if I say that I doubt if they were to blame in the least. They were faced with a complex problem of extreme difficulty, and sought to form the best theory they could, to account for their accepted data. We physicists have often been in that difficulty—we are so now, most acutely, with respect to the theory of light and radiation. One great mass of phenomena, long known in great detail, is very perfectly interpreted by the wave theory; another rapidly growing mass of quantum phenomena seems to demand something quite different. At present we cannot reconcile the two. No one has yet succeeded in developing a single consistent theory which will account for all that is known. We have no doubt that this is our own fault,—that such a theory could be designed,—and we hope that someone will soon have the insight to develop it. Meanwhile we are "carrying on" by using each of the

two theories, in its own part of the field, though we know that neither, in its present form, is consistent with the other, nor with all the facts.

At an earlier stage, when the known facts which had not been accounted for by the wave theory were few, and seemed relatively unimportant, physicists simply kept to the theory, making it clear, however, to themselves and to those of their students who knew enough to understand what they were talking about, that the wave-theory was probably in need of some improvement, which could not yet be undertaken.

The Fathers of the Church, faced with the problem of developing as good a theory of Christianity as they could, found a mass of data which they were convinced were of vital importance, which were explicable in a satisfactory fashion by the doctrine (theory) of the Divinity of Christ. The discordant data were few and apparently of incidental importance. They could not reconcile the two, and, if they proceeded to drop the inconsistencies from mind, they did not really behave very differently from modern physicists at the beginning of the twentieth century—

except that they did not recognize that their theory, though good and useful, was not perfect. But it has taken centuries of experience to cure mankind, even partially, of making swans out of geese,—of believing that the good even the very good, is perfect,—and our forebears had not had much chance to learn this lesson.

We all know how, a century or more ago, when the age of Jonathan Edwards had passed into that of Jefferson and Channing, many sincere and able men found the ancient theology intolerable, and abandoned the old theory, substituting one which took the second group of sayings of Jesus at quite its full value, and threw the onus upon the first, —also how Unitarianism, in spite of the wide latitude of opinion which prevails within it, has failed to convince more than a rather small minority of the open-minded students of the matter that its theory regarding Jesus is actually better than the old one.

The older and newer theories are irreconcilable; but is this true of the data on which they are based? Is there no hope that the future may give us a theology in which *all* the sayings of Jesus may be accepted on

equal terms? I believe that there is such hope, and that notable aid in the reconciliation may come from the side of science,—and, what is more, from the apparently barren region of modern mathematics. Back of the affirmations of the Athanasian Creed and the Westminster Confession lay probably some such reasoning as this. Jesus claimed, and possessed, powers that were clearly Divine—He was God manifest in the flesh, and therefore equal with God. But the whole cannot be equal to its part; therefore Jesus possessed all the qualities and attributes of God; otherwise he would not have been Divine. This conclusion rests on two premises, the minor, specific one derived from the Gospels; the major and general premise from abstract philosophy. And it is the major premise that is now more than doubtful.

What! the whole not greater than its part! Was Euclid wrong? Well, this is a mathematical question, and so the modern mathematics comes in—the theory of infinite, or as they are technically called, transfinite numbers. Though not widely known, the parts of this theory which we shall need are really very simple, and need no special mathemati-

cal knowledge to understand—so bear with me while I explain them.

A number is obviously a property belonging to a group of objects (which may be of any kind whatever so long as they are distinct and identifiable). Two groups have the same number when a "one-to-one correspondence" may be set up between them. To do this, we match some particular object in the first group with some one in the second, then form another similar pair, and so on. If when such a correspondence has been set up, no unpaired objects appear in either group, so that to any given object in one group corresponds its mate in the other, with none left over in either case, there is a one-to-one correspondence between them—and it is obvious that the number of objects in the two groups is the same. But if in attempting such a match, one group is found to be exhausted while some elements are still left unmatched in the other, the numbers in the two are unequal, and the second is the greater.

Finally, if from any group, some of the elements in it are removed, what is left constitutes a *part* of the group.

All these relations appear almost too obvi-

ous to demand formal statement; and so they are, when applied to the small groups which are familiar in ordinary affairs. In such groups, and in all finite groups,—that is groups in which the process of picking out one element after another must ultimately come to an end, exhausting the group—it is always true that the whole is greater than the part. If some elements are removed, those which are left cannot in any way be matched with the whole set.

But things are quite different in the case of *infinite* groups. A very simple illustration suffices to show this. Consider *all* the numbers, the positive integers in order, 1, 2, 3, 4, 5, . . . and so on without end. This is a definite group of objects. Now erase from it every number which is not an even million, and leave the millions only. What remains is evidently but a part of the original set, and a very small part, for 999,999 numbers have been erased for every one that was left. Have we now fewer numbers in our set than before? Try it. Write the two sequences underneath one another in order

1	2	3	4
1,000,000	2,000,000	3,000,000	4,000,000

and so on, and we see a strange thing. To each number in the upper row corresponds one in the lower, just a million times as great. 385,000,000 to 385, for example; and, conversely, picking out any even million in the lower row, we find a corresponding number, a million times smaller, in the upper row. There are as many numbers in one row as in the other—there is a one-to-one correspondence between them. This time, then, the whole is *equal* to its part,—indeed, to what, looked at in another way, we would call a millionth part of itself.

It is easy to see that this surprising result depends on the fact that both series are infinite, so that neither can ever be exhausted, and it is not hard to prove that this property of being equal to a part of itself is characteristic of *any* infinite aggregate. It is indeed, exactly this property which distinguishes the infinite from the finite.

But I must not pursue this mathematical reasoning farther,—though the topic is a fascinating one,—for we have what we need for the purpose in hand. We have shown that the philosophical premise, not the religious

premise, of the old-time theology was incomplete,—indeed erroneous.

To pass from mathematics to theology—from the properties of infinite numbers to the attributes of an infinite God—is a far cry; but the principle which has just been explained would appear *a fortiori* to be true. By the analogy of nature, in another form, we have come to realize that an infinite God might have a manifestation which was itself infinite, and hence godlike, Divine, differing in its essential nature from any finite being, —and which nevertheless did not contain at all certain characteristics of God,—perhaps a great many of them.

Does not this make it possible to hold that both the sets of sayings of Christ may be literally and equally true?—that the one group refer to those Divine characteristics which were present in this manifestation, and the other to those which were not? Theologically, this is no novelty; it is only a form of the doctrine of the Kenosis—the voluntary abnegation of certain Divine attributes—which has taken a very important place in modern Christology. But the application of the mathematical analogy to the matter is

less familiar,—indeed, it may, so far as I know, be new,—and I hope that it may throw some light upon the problem.

What the Christology of the future may be is not for me to predict. I will only hazard the guess that not one, but many, theoretical formulations of the nature of this manifestation of the Divine may prove possible, and the hope—which the trend of present discussions appears to encourage—that Christian people may learn to live in unity without demanding exact agreement upon such points of theory—remembering that the tests which Christ himself set up were of a very different character—theoretically simple and practically very hard,—to forget oneself, carry one's load, and follow Him.

III.

BODY AND SOUL

BODY AND SOUL

AMONG the many religious problems with which our modern world is occupied, there is none which arouses a more widespread or deeper interest than that of human immortality. Whether we—our real selves—will outlast the termination of physical life concerns us all; and not our personal desires alone, but our strongest and most unselfish emotions,—and it is of no less concern, if we have any such future, of what nature it may be.

In this disillusioned world we find multitudes in perplexity, doubting the conclusions of an earlier time, seeking eagerly for evidence, any evidence, and sometimes accepting alleged evidence of very strange kinds.

What has science to say here—not merely about this evidence, of course, but about the whole great problem? and what may we reasonably believe, or hope?

In the stricter sense, when we deal only with those matters which are ascertainable by observation, science tells us only the little

that we knew before, and that little is purely negative. When the body dies, the soul—and by "soul" I mean here the personality, the conscious individual who understands, feels, remembers, responds to us—vanishes utterly from our ken. A little while before, perhaps only an hour, this personality was still accessible, and then we lose all trace of it.

> As if we had talked, in following one
> Up some long gallery. "Would you choose
> An air like that? The gait is loose
> Or noble." Sudden, in the sun
> An oubliette winks. Where *is* he? Gone.[1]

So the poet puts it—and science has not a word to add. We know the fate of the body; of that of the soul we can discover nothing. If it survives, it must persist in a world, a realm, which has no contact with ours, or at least none which we can in any way discern.

Doubtless some will disagree with me at this point, believing that there *is* evidence of such contact; and the matter is so much discussed that it cannot be passed by in silence. On topics such as this I cannot speak with expert authority, nor as one who has made a

[1] "Died," Mrs. Browning.

comprehensive study of the matter, but I did not speak without good reason a moment since. I would by no means assert that it is absurd, or impossible, that evidence of the survival of bodily death by human personalities might be forthcoming, which should be of such a nature as to satisfy even the severe requirements of scientific investigation. Still less would I question the value and importance of "psychical research" conducted by unprejudiced and competent investigators. Yet, even so, if I try to imagine a crucial experiment, some conclusive test which, if successful, would settle the question of survival in the affirmative, I find myself baffled. The assumption of telepathy,—that one living mind may transfer ideas to another (perhaps quite unconsciously) in the absence of all ordinary means of communication, and at a distance,—though remarkable enough, has some evidence in its favor; but at least we are sure that both these minds are in active existence. The assumption of a similar influence on the part of a disembodied spirit involves the additional postulate of the existence of such a spirit; hence, by the ordinary rules of scientific work, it should be adopted only when the

phenomena cannot be accounted for at all on the first hypothesis.

This rules out, as decisive evidence, the communication of anything which, at the time of its receipt, could have been known to any living person. Cases might well be imagined of a communication (for example, of the contents of a sealed envelope) which was presumably unknown to any living person after the writer's death. But it might be that the "message" passed from the mind of the writer, while still living, to that of the recipient, there to lie latent till some later time; or that it was relayed through some third person, without rising above the level of his consciousness.

It is extremely hard to imagine a case which could not be explained in some such manner as this; and so long as an alternative interpretation, not involving the existence of disembodied spirits, is possible, the phenomena cannot be decisive in favor of their actual existence.

As for the much discussed material manifestations which are attributed to supernormal activities, I feel that I should almost apologize for referring to them at all. The

circumstances under which they are ordinarily produced afford an ideal opportunity for trickery (which, of course, need not always be conscious on the part of the medium); and so much actual trickery has been detected that they must be under very grave suspicion. At the utmost, they could hardly prove the existence of *human* survival, unless accompanied by personal messages which passed the tests already discussed.

Do not understand me to say that the establishment of human survival by scientific means is hopeless. It may be that, some day, such a weight of well-established evidence may exist as to make survival probable. But at present we are exceedingly far from this goal.

The upshot of these considerations is that, if our souls are immortal, they exist, after death, in a region inaccessible to present means of scientific investigation. This disposes of the question from the scientific standpoint,—it remains one upon which science must adopt an attitude of complete agnosticism. But this does not take it out of the reach of philosophy. We may still ask, Is the belief in human immortality reasonable? What

arguments, direct or indirect, are there for it or against it? How does it fare, when regarded as a metaphysical or religious problem?

We must frankly recognize that here, on the surface, science appears to be less favorable to accepted religious views than in any case which we have previously considered. Though science has nothing to say about the soul apart from the body, it tells a great deal about the relations of the living body and the personality, and what it tells us is disquieting. While the body functions normally, so does the mind, but a mere accident—a blow or shock, a few breaths of gas—will temporarily abolish consciousness, while many of the bodily functions continue. Anything that disturbs the higher centers of the brain disturbs the mind, and, what is worse, often apparently alters the character. The effects of the ingestion of a few ounces of alcohol are proverbial. Much smaller doses of certain narcotic drugs have an appalling influence, producing a rapid degeneration of the higher characteristics of the individual,—which also, alas, is a matter of common knowledge. If the

mischief has not lasted too long, a return to normal is possible, under proper treatment.

Not only external poisons, but internal disturbances of the body, may affect the personality. The hopefulness of the consumptive is again proverbial. Every medical man, though not the average layman, knows of a dozen other instances. For example, a man suffering from hardening of the arteries is likely to become censorious in his judgment, and from a good-humored fellow to turn into a martinet; to brood on real or fancied wrongs far in the past, not because of any deliberate change of his attitude toward life, but simply owing to the progress of his disease. When, to the uninformed onlooker, he may appear peevish and irritable, it may well be that he is making the bravest struggle of his life against these defects of temper, though not always succeeding against the overwhelming odds.

But I know of nothing that puts the intimate connection between soul and body more clearly, that shows better how the obviously material conditions what is supposed to be the typically spiritual, than a sentence which an uncle of mine—a student of Lister's in the great days when antiseptic surgery was new

—brought back from Edinburgh. "No one ever died a triumphant death of trouble below the diaphragm."

All this raises a very serious question. If the operations of the mind—nay, even the very character of the individual—are so intimately and so greatly affected by disturbances in the normal functioning of the central nervous system, is it reasonable at all to suppose that mind and character may survive the utter destruction of this nervous system? Do not the facts indicate that the "soul" is a product of the body, and perishes with it? In common honesty, I think that we must admit that there is a presumption, on the face of the evidence, against the hypothesis of survival. But presumption is not proof; the history of science is full of theories which have won their way on their merits, in spite of a presumption against them at the start. What theory, then, concerning the relation of soul and body may overcome this presumption, and make a belief in immortality credible?

It is time now to define a little more carefully what I mean by "immortality." By it I mean the survival of the conscious individual, with reason, emotion, and memory, after the

disintegration of the body,—a *personal* immortality in its full sense. The word is often used in other senses, and, I think, misleadingly. People speak of the individual personality being reabsorbed into some great whole, whence it came. This is a fine conception, when understood at its best; but it is not immortality, in the sense in which men are concerned about it, any more than the reappearance of the matter which constituted the body, as a part of other organic or inorganic forms, constitutes the persistence of the individual life.

No more do I find immortality in the ancient doctrine of the transmigration of souls, —the belief that in the living man, and perhaps in all living animals as well, there is some essence which escapes death, only to be reincarnated in some other living creature, and so to pass on indefinitely. The obvious difficulty with this is that, since no man has a memory of an earlier life, we must suppose that memory, and all consciousness of personal identity, disappear at each transmigration. All that remains is the persistence of some vague "soul-stuff" of whose existence we have no evidence. The belief that this car-

ries on with it to the new life, not memory of the past, still less the knowledge or power to retrieve harm or damage that is still reparable, but only some acquired merit or demerit, appears to me to be little better than a travesty on the idea of eternal justice. That we suffer, or advance, because of deeds done in the flesh by someone else, quite unknown to us, before our birth, is a doctrine worse than the one which Ezekiel rebuked, for it would tell us "The fathers have eaten sour grapes, and the *strangers*' teeth are set on edge." In the face of such a belief, which regards man as bound helpless upon the ever-moving wheel of Nature, the conclusion that death ends all would come as a message of freedom.

But these speculations do not really concern us occidentals very much. Another philosophical problem comes nearer home. If the human soul is immortal, and endures indefinitely, as a conscious personality, after the death of the body, where was it before that body came to be? This is a riddle indeed, and the attempt to solve it has driven some to belief in transmigration, despite all its difficulties. Orthodox theology answers that each human soul is an immortal entity, created by

God and associated with the body, at the instant of its formation, so that the soul has a beginning in time but no end. What may we believe now concerning this?

Science cannot aid us directly in solving these problems, for, as has already been said, they are outside its range. But, as in so many other instances, science can be of great indirect aid, in expanding our imaginative powers, and enabling us to form hypotheses which we would otherwise never be likely to think of at all. In such attempts to find a clue, analogy is a legitimate and very valuable guide; and it is to a certain analogy, and the hypothesis which it suggests that I would now ask you to devote your careful attention.

The analogy is an old one, running back into the days of the classics, and perhaps much farther, yet with the new understanding of nature, it takes on a deeper meaning. It is built upon the ancient comparison of life to fire.

A flame, for example, that of a candle, has many striking points of resemblance to a living organism. First and foremost, it is a going concern, kinetic, not static, deriving its characteristic features from processes

which go on within it. Like the living body, the flame has a structure, but in both cases this structure is not always composed of the same material atoms. Without straining the analogy the flame may even be said to have organs—the dark space near the wick, filled with vapor, the bright portion, where combustion is incomplete, and the separated carbon becomes incandescent, and the outer feebly luminous sheath where combustion is complete. Like the animal, the flame has its own metabolism, and one which, from the chemical standpoint, is remarkably similar. It feeds on material from without—the wax of the candle, carried up the wick and evaporated there; it breathes in air, which furnishes it with the required oxygen; and breathes out a stream of heated gases, which contain exactly the same waste products (water vapor and carbon dioxide) which are thrown off by the lungs. Interference with these essential supplies disturbs the metabolic process. A drop of water on the wick makes the flame sputter; if the supply of air is partially cut off, the flame becomes lurid and smoky. If the interference does not go too far, the flame comes back to normal when it

is removed; it has been sick, and has recovered. But if the disturbance is greater, the flame, after more or less disorganized struggling, goes out,—it is dead.

A new flame may be lighted upon the old wick; but we have no doubt that it will be a new one, and not the old. With the cessation of the continuous process upon which the old flame depended for its existence, its identity was lost. How sure we are of this we perhaps realize best when we read the story (I hope apocryphal) of the pretty American tourist who was taken by a friendly Russian officer of the old régime to see the spot where a sacred flame of natural gas, adored by the primitive natives, had been burning for centuries. "Puff!—now the old thing's out" was all she said. Her companion, fearing massacre, instantly struck a match and relighted it, —but it was not the sacred flame, though the natives were none the wiser.

The likeness, then, between a flame and a living man is close; but does this help us at all? When the candle is blown out, what of the flame? Is it not dead and gone forever, and does not our analogy cut off the last hope?

So it might do, if we were blind. If we knew nothing of the flame but the material phenomena which happen within it,—its form, its size, its temperature, the successive chemical changes that occur, all of which might conceivably be studied by a blind race armed with suitable instruments,—we would say that when these changes ceased, the flame was utterly at an end, and that nothing remained of it anywhere except the memories of its action, and the effects which it had produced.

But we can see, and we know that the flame gives light. We can blow the flame out; do we really blow out the light? Far from it; light moves in another realm, where we cannot thus extinguish it. The flame dies; but the light persists.

If our candle were out under the stars (rather than in the artificial environment of a closed room) its light, in the twinkling of an eye, would escape far beyond the atmosphere, out into empty space, and there it would go on for ever. So the science of optics assures us; but the light of a single candle is so feeble that it is hard, even in imagination, to follow it for even a second's travel. We may do better by taking now the example

of a greater blaze—of those vast outbursts of incandescent matter which cause the appearance of the *novae* or "new stars."

Now and again, among the many millions of stars which fill the heavens, some star undergoes a sudden catastrophe. We do not yet know its cause; but it is evident that a sudden and tremendous liberation of energy takes place. The surface of the star is intensely heated, and driven outward in all directions at an enormous speed, flying off into space, and in a few months forming a rapidly expanding nebula surrounding the star, which has in one case, at least, been followed for years before it faded out. The star —perhaps originally brighter than our sun, perhaps fainter—shines for a few days, while the paroxysm is at its height, with ten thousand, or even a hundred thousand times the sun's light. Then, as what is left of the heated matter settles back on its surface and begins to cool, the brightness falls steadily, until after two or three decades the star is left almost as it was before the outburst.

We astronomers have seen not one or two, but dozens of these objects, which for the most part follow so similar a course that it is

evident that the process, whatever it may be, is governed by definite laws, and conforms to a specific type.

Essentially, therefore, it is like the flame, a process proceeding according to definite physical rules, within a certain mass of matter, consuming a part of it, and leaving the rest much as it was before. What is left of the great disturbance after it has run its course? So far as we can tell by observing the star, all conspicuous traces of the affair, great as it is, would be practically gone at the end of a century. In a little longer time (and a century is less than a moment in the life of a star) there could probably be found no evidence, in the star's own condition, that the thing had happened; but we can see it, nevertheless.

A great new star appeared suddenly in the constellation Aquila on June 8, 1918, blazing up to ten thousand times its original brightness in two or three days—at least, we say that it appeared then, because we saw it on that date. But the blaze which set the light going did not happen then. There are ways in which we can find the distance of a star, and in this case we have good reason to

believe that *Nova Aquilae* is so far away that its light takes a thousand years or thereabouts to reach us. This star, then, really blazed up before the Crusades; before the Norman Conquest of England; perhaps when Alfred the Great was king. We have already watched it fade almost to what it was before; in reality the tremendous flame must have passed altogether away many centuries before we knew of its occurrence.

Here, again, we might imagine a student, concerned only with the material processes which happened in the star, who would conclude that the disturbance belonged to the past only; it was now a mere matter of record; it was dead;—and all the while the light which came from it would be carrying the news of it to us in the present and on its way to other stars which will not receive the information for centuries yet to come.

And this light, so far as science now knows, is perennial. It goes on into space, in ever-widening spheres, it is true, but carrying as a whole an undiminished amount of energy. Nothing can stop its course, except the accident of meeting with some material body and being absorbed by it. Otherwise it lasts for-

ever, and it is forever individual. Waves of light do not lose their identity—do not become merged indistinguishably into some vague, undifferentiated store of energy in the universe. (Physics knows of no such store.) However weak they are, they still carry with them the image of their creator,—of the source whence they sprang.

After well nigh a million years' travel, light from novae in the great nebula of Andromeda still reaches our telescopes—coming in a definite direction, and so telling us where the star is (or rather where it was a million years ago); coming with a definite intensity and so telling us how bright the star was; changing in brightness from day to day, and so bringing us record of the succession of events that passed, perhaps, before anything remotely human lived upon earth; and coming, not as one kind of light, but as many, which, when analyzed by our spectroscopes, show evidence that the same processes have occurred in these remote stars as in the brighter ones near us.

It may be noted, too, that light-waves coming from different stars do not—indeed, they cannot—interfere with one another. Light

from a hundred thousand stars may simultaneously enter the objective of a great telescope, and each particular set of waves will be brought to its own focus, and form an individual image of its parent star.

All these amazing things depend on the great fact that, in the order of Nature, there are two realms, which, in common phrase, may be distinguished as matter and ether, the realm of mass and motion and the realm of radiant energy. Considered from one standpoint, the realm of matter is *closed*;[1] transactions which occur within it change the forms in which matter appears, the chemical combinations of which it consists, but do not alter its amount. Matter is *conserved*. From this standpoint then, a fully informed student who knew matter, and no more, considering the flame, might conclude that everything that went into it could be accounted for; coming out, atom by atom, in different combinations, but in unaltered amounts. So long as the process which is the life of the flame lasts (he would say) the flame has an

[1] Disregarding certain possibilities predicted by the theory of relativity and perhaps realized in the interior of the stars.

individuality—it is the same flame. But when this process comes to an end, the flame is dead and gone. The atoms which once formed its body are now parts of other things; only a memory and the results of its influence on other bodies remain. It has perished forever.

But there is another conservation besides that of matter—the conservation of energy. Our imaginary student would know nothing of that. He would conclude that, although in many processes (such as those involved in the motions of material bodies) energy was conserved, yet in others, such as the flame, energy mysteriously vanished and left no trace; while in still other cases, such as in open ground upon a hot dry day, energy as mysteriously appeared without assignable origin. We, who can see, know more. We know that the energy lost from the flame has not been annihilated, but has escaped into another medium (which the best physical authority still allows us to call the "ether") and persists there in unaltered amount; and, in the hot noontide, we know that the heat which is flowing in has come, by similar radiation through space, from the sun.

It is this radiant energy—light—of which

we have been speaking, and it has appeared that, when this wider conservation is considered, though the flame, whether of candle or star, is dead and gone, its light lives on—undiminished, individual, immortal.

It is well worth remark, also, that although light exists only in the ether, it never originates (so far as we know) except in the presence of matter. Light is not produced in empty space; it comes from atoms, which, having in some way acquired a store of energy, liberate a part of it into the ether in this fashion. If we neglect for the moment processes which occur very rarely outside the laboratory, we may say, in the large, that light comes only from hot material bodies. Unless they are fairly hot they will not shine visibly; unless they are much hotter, they will not give out a full white radiance. We must have matter, and matter in the right physical state, if light is to be born; but the matter may cool down and cease to shine without affecting in the slightest degree the light which it has already emitted.

After this long excursion, let us return to the problem of body and soul, and consider whether, aided by this analogy, it may not be

possible to build up some theory of their relation which fits the facts, and leaves room for immortality. I believe that this can be done, but that certain postulates are necessary, which, by their very nature, go beyond the data of science.

Let us first postulate that the realm of matter and energy—that of physical nature—does not constitute the totality of all things, and that there exists also another realm which, for the sake of a name, we will call the spiritual realm. I hesitate to use the word, convenient as it is, for fear that it may carry with it a multitude of associations; let me therefore hasten to say that, for the moment, all that I mean by this spiritual realm is one governed by laws of its own, which bears a relation to the physical realm of matter and energy somewhat resembling that which the realm of matter and energy bears to that of matter alone, so that the two may interact without in the least disturbing the laws of conservation which hold in the less extensive realm, just as the existence of radiant energy does not disturb the conservation of matter.

In the second place, let us postulate that the human consciousness,—character—"soul" if you will—belongs in some way to this spiritual realm, as light belongs to the realm of the ether; while it is related to the body somewhat as light is related to hot matter (or, more generally, to the atoms whence it comes). Using deliberately the physicist's somewhat vague word, we may then call a human personality a "disturbance" in the spiritual realm, and follow our analogy farther.

A disturbance of this kind (a conscious personality) if the analogy holds, cannot originate in the realm of pure spirit. It demands for its inception the existence of a physical system of an appropriate sort, which in this case must obviously be assumed to be a living body, with a nervous system and brain of sufficient and appropriate complexity. When such a body comes into being, we may suppose that the personality, in an embryonic state, automatically comes into being too, under the laws which govern the interaction of the physical and spiritual realms, and that both develop together. In-

deed, the postnatal stages of this process are observable, and so familiar that we forget how marvellous they are.

The fact that characteristics of the personality appear to be almost as definitely inherited as are those of the bodily frame now falls quite into line, as do also those relating to the effects of disturbance of the body upon the mind.

But we need no longer suppose that the dissolution of the body involves the extinction of the soul. Just as the light survives the flame,—the disturbance in the ether outlasting the disturbance in matter which produced it,—so the soul, in the spiritual realm, may survive the physical body whence it came. Our analogy, indeed, leads to the belief that the soul may survive indefinitely, through an unlimited time, retaining its full individuality, never becoming merged with any other personality or lost in some vague undifferentiated whole.

We must not, of course, push an analogy too far. It would be absurd, for example, to assume that the soul, when clear of the body, must spread out into space of three dimensions with a velocity of 186,000 miles per

second, just because light does. We need not, moreover, assume that, because the light radiation from a star bears with it only an unalterable record of the past, that the soul carries with it into eternity only a recapitulation of the events of its bodily life. Growth is of the very nature of personality; and to assume that the detailed analogy breaks down here is reasonable.

This theory of the relation of soul and body is probably far from original. Though I cannot recall where I first met with the idea, I have no doubt that it is old, though the details of presentation are my own. It appears to me to have many advantages. It accepts fully the biological and medical facts, and like all that I have said, is founded on the mechanistic conception of phenomena strictly determined by law. It meets, in a manner which I, for one, find satisfactory, the old philosophical difficulty about a "one-way" immortality,—a life with a beginning, but no assignable end,—and provides an immortality personal and individual enough to satisfy the most Occidental type of mind. It is, of course, just as consistent with theistic beliefs as is any other theory, for, as in all similar

instances, the supposition of a particular mode of orderly Divine action leaves the origin, of the body and soul alike, still altogether in the hands of God. In this respect it differs from the old orthodox theology only in substituting the conception of an orderly process for that of "special creation."

It may be objected that it makes the body antecedent, and the soul derivative; but, if the soul be immortal, though not preëxistent, what does this matter? Indeed, the alternative view, that the soul in some way clothes itself with a body, would lead us into far more difficulty.

It may also be noted that while it makes immortality indefinite in duration, it does not demand that every individual soul shall endure eternally. There may be laws within the spiritual realm under which a personality (for example, one which persistently refused all opportunities of advance and righteousness) might become extinguished. The believers in conditional immortality may therefore find room within this hypothesis, while those who believe in the inherent and inviolable immortality of all men are in no wise excluded.

Lastly, and most important of all, the immortality which is here sketched is one in which the characteristics of the personality persist after death,—subject, however, to the possibility of gradual change, such as occurs during ordinary life. Such changes may well happen—everyone who hungers and thirsts after righteousness must hope for them,—but, after the moment of death, he that is filthy will be filthy still, and he that is holy, holy still.

All may be summed up in a sentence. The hypothesis which is here suggested adds a new spiritual realm to those of matter and energy, and a new type of conservation; it affirms the *conservation of character*.

But all this is frankly speculative. My purpose has so far been to develop a theory of the possible nature of the human soul which shall escape the unfavorable biological presumption, and make immortality a credible hypothesis. But is it more than this? Men and women *may* be immortal,—that is the best fruit of our labors so far. What reason have we to believe that they *are?*

We cannot expect to find such reasons in the field of science, for, by our very hypothe-

ses, immortality is a matter external to this field. We must go to philosophy or to religion; and, in my judgment, the reasons for belief in immortality are definitely religious in nature.

Other arguments may be adduced; for example, the old one that men of all races and ages have believed in immortality and that such a universal human conviction must correspond to reality. To this particular argument, I can attach very little weight—the unanimous opinion of mankind has too often been wrong, and the strong emotional pressure behind the primitive belief is too obvious. There are other philosophical arguments, of course, of much greater weight, which must be taken seriously; but the religious arguments appear to me to be still stronger, and it is to them that I turn.

I would not attempt to prove immortality first, and reason from belief in it to belief in God; but belief in God, based on quite different grounds, may lead to belief in immortality. The latter, as I see it, is not a primitive and fundamental proposition of religion, but deduced and secondary.

The religious arguments for belief in hu-

man immortality are varied, and I have time to speak of only three. These are supplementary to one another, and which one carries the most conviction to the mind of a given individual will depend very largely upon his own intellectual type and temperament. If then, I say that, in the order in which I set them, they happen to appeal to me with increasing cogency, I do not expect, or even ask, that you shall all agree with me in this detail. In such a matter every man must judge and feel for himself.

The first of these reasons is historical—the teaching and authority of Jesus Christ. That He believed in immortality there can be no possible doubt. We do not have to do here with one or two isolated sayings, whose authenticity may be debated. His whole teaching is shot through with it,—it was evidently to Him a primary fact.

Here, I think, by the way, that Mr. Wells has fallen from grace as a historian. In his *Outline of History* he devotes considerable space to a very striking and thought-provoking account of the coming of Christianity into the world, written with a sincere desire for impartiality and with notable skill. But,

in his summary of the teachings of Jesus, I think that he is wrong in substantially ignoring his profound belief in human immortality. A hypothetical reader, who derived his first knowledge of the Prophet of Nazareth from this account, would gain an imperfect idea of his doctrines.

I have no doubt at all that Mr. Wells, in this omission was moved by admiration for Jesus. Being convinced, as other passages in his writings make it clear, that the belief in, and desire for, personal immortality are selfish and unworthy of humanity at its best, one can hardly blame him for minimizing what appears to him as this defect in the teachings of a character whom he admires so greatly. It is a generous failing, but in a historian still a failing. The teachings of Christ are based on the belief in personal immortality, as thoroughly as those of Buddha are based on belief in transmigration.

So much for the historical basis of this argument; now for its religious side.

To vast numbers of good men and women, no other argument is necessary, and no other appears of comparable importance. Having concluded from independent evidence that

Jesus Christ was God manifest in the flesh, they accept His teaching as the final word.

From what I said in my last lecture, you will realize that I am very far indeed from being unsympathetic with this point of view; but has the teaching of Jesus no message here for those who find themselves unable to go all the way with these conclusions of orthodox Christian faith,—to the devout Jew, to the sincere agnostic?

I believe that it still has; to such a hearer I would say: Leaving all theology aside, it can hardly be denied that in Jesus of Nazareth we find the greatest religious genius whom history has yet recorded. Here is a man whose conceptions of love and righteousness, of man's relation to his fellows, of God and His relations to man, stand alone in their amazing insight.

If no other evidence at all on the question of immortality were available—if otherwise we must suspend judgment in pure agnosticism—would not the settled conviction of this religious genius, this man of extraordinary insight, be a fitting guide?

That fine Englishman who wrote from the trenches as *A Student in Arms* left us the

noble epigram, "Religion consists in betting your life that there is a God." Like all good epigrams this is so condensed that one must think a bit to see its full meaning. "That there is a God" means of course a God of order, goodness, love—all the things that it was hard to believe in the trenches—but the central truth lies in the phrase about "betting your life." It recognizes the necessity—the real, practical, unavoidable necessity in every-day life—of making a venture of faith, and going beyond the limits of clearly ascertainable security, even in matters upon which everything depends for us. With this in mind I would say in all earnestness to a friend who in no wise professed or called himself a Christian, "Have you anything else better to bet your eternal life on (or your doubts whether you can have any) than the simple opinion of Jesus Christ?"

Before I leave this topic it may be permissible to point out that the kind of immortality in which Jesus believed is strikingly similar to that which was worked out, on purely natural analogies, earlier in this talk. Jesus accepted the plain fact of the separation of the living and the dead—indeed he said very lit-

tle, even in parable, to support the idea of communication between them. He never appears to have taught the preëxistence of the human soul (what he said of himself was regarded by his hearers, and clearly meant, as a claim to be more than human); but he believed firmly that the soul, individual and conscious, with reason and memory, survives death. Last, but not least, no one ever taught more plainly than he the continuity of character. The works done in the body determine the subsequent destiny of the soul.

But I must pass to my second argument, which is quite a different sort, and based on ethical considerations,—on the belief that God is just and righteous.

Justice is a high thing—whatever the attempts to realize it that we find in the laws and courts may be—and it is of the essence of justice that rewards shall be proportioned to desert, and, so far as possible, opportunity to need. But in this world of ours it is too often far to seek. We need not dwell upon the sorry tale of war and anarchy. Even in these days of peace and prosperity, the land is full of things that

> accuse the sins
> Of earth's tormentors before God the just
> Until the unconscious thunderbolt begins
> To tremble in His grasp.

But it is not of the guilty that I would bid you think, but of the innocent. Justice to the criminal may well involve, as its major purpose, his restoration to normal and honorable life, if this be possible; but what of the victim whose only fault was to be in the way? Where can we find justice in his fate?

If death ends all for men, we have no answer. "All things come alike to all; there is one event to the righteous and to the wicked, to the good and clean, and to the unclean . . . the heart of the sons of men is full of evil, and madness is in their heart while they live, and after that they go to the dead."

"For the living know that they shall die; but the dead know not anything, neither have they any more a reward; for the memory of them is forgotten. Also their love, and their hatred; and their envy, is now perished; neither have they any more a portion forever in anything that is done under the sun."

So said the Preacher long ago,—and what is there more but to echo his somber warning.

"Whatsoever thy hand findeth to do, do it with thy might; for there is no work, nor knowledge, nor device, nor wisdom, in the grave, whither thou goest."

If this is the whole story, we may still see a grand and rough-hewn justice on the larger scale, governing the rise and fall of nations, the fate of civilizations and races,—but only this generalized statistical justice (if we may so speak) remains in the designs of Providence. Yet, in our own lives, there is more. The call still sounds, "Hath man no second life? *Pitch this one high!*"—and, in human affairs, we do all that our wisdom and power permit to restore the disordered balance, and secure liberty and justice for all. That this effort, rightly made, is worth while, we can be sure, if we can be sure of anything,—and is this passion for justice to be found in human hearts alone? Shall "here, the creature exceed the Creator"? A good God must be no less, indeed, far more concerned with justice and mercy than we. And this leads straight to the belief that, in His designs, He has provided for "a new world, to redress the balance of the old"—another life in which the inequalities of this find adjustment.

Belief in the Divine justice, then lends compelling force to the belief in man's immortality. How this justice operates in detail in another life, we may not all agree.

The modern sense of continuity in nature and its processes supports the belief that the adjustments, and especially that clearing of defects from the individual which is so undeniably to be hoped for, and is desired most eagerly by the best of us, is made by a gradual process, perhaps bearing some resemblance to that of education here. This is a very old idea; though the details of the ancient conception of it may need change.

Again, there is good reason to hope—nay, to believe—that the Divine concern for the welfare of each individual never comes to an end, that the possibility of amendment and of God's help remains always open. This is called a modern doctrine, and unorthodox; but it was a Calvinistic theologian of the school of the last century who said "I believe that the Spirit of God is acting continually even upon Satan himself, and restraining him from greater evil."

Finally, though these beliefs remove the cruel terrors which sprang from those hard

old beliefs which made the fate of the soul in the world to come dependent irrevocably upon some features (too often formal) of its relation to religion here, they are very far from making it a matter of indifference what the nature is of the character with which a man leaves this world of ours. Character persists, and, in a world designed by a just God to redress the balance of this, the filthy, the cruel, the greedy may not anticipate the satisfactions which they have learned more and more to crave.

Of all the reasons, however, for belief in human immortality, that which makes the strongest appeal to me personally, and, I believe, does so to many others also, is my profound belief that God is "wont to give us more than either we deserve or desire"—in an abiding sense of His bounty.

It may be that men whose lives have been spent in studying Nature feel this more than others, but for them this impression is overwhelming. Our conceptions of the universe and of its parts have changed, and are still changing, but one feature is common to these changes, as men passed from the simplest naïve ideas, step by step, to the wider but still

imperfect vision of the present. Nature grows more wonderful to us—more splendid, more beautiful. The crystal vault of heaven, lit with starry lamps, which the skies presented to ancient imagination, was a beautiful picture. It is gone forever, and in its stead we have the awful grandeur of the star-sown void of space. The world of our fathers, hardly a century ago,—six thousand years of age, made in the space of six days,—gives place to one so old that, in its history, a thousand years are, not as one day, but like the swiftest twinkling of an eye.

The Psalmist, thinking of the origin of his own body, said, "I am fearfully and wonderfully made"—but how little did he know of the transcendent wonder of life, the almost inconceivable intricacies of the structure of the living body; of the marvellous interplay of influences that takes place within it; of the wonder of its development from one almost invisible cell along an intricate and unerring path?

There is no time to multiply instances,—but what produces the profound impression on the mind of the student of science is the uniformity with which each new advance

makes Nature show more grandly. I can recall but one instance when a theory was justly described as "grander than the truth." My old teacher Professor Young, used these words twenty years ago, in speaking of the theory that the nebulae are vast galaxies of stars, external to our own. On the basis of the evidence which was then available, his remark appeared to be justified; but the work of the last year or two has shown conclusively that this theory—though certainly grand enough—is *true*, and that both our own galaxy and these remote nebulae are far vaster than anyone then supposed.

This is true in the material realm. God's universe is far greater and more splendid than at first it appeared to us, and its splendor grows more and more as we search it out. Is it not likely to be fully as true in the moral and spiritual realm? We can hardly put matters to the test here, as effectively as we do in the natural world; but this may more reasonably be ascribed to the protozoan limitations of our own powers than to any limitation on God's side.

The need for some venture of faith still remains; one must stake one's life upon some-

thing. For myself, if I am to stake all I have and am and hope to be upon anything, I will venture it upon the abounding fulness of God—upon the assurance that, as the heavens are higher than the earth, so are His ways higher than our ways, and His thoughts than our thoughts. Just what future the Designer of the universe has provided for the souls of men I do not know, I cannot prove. But I find that the whole order of Nature confirms my confidence that, if it is not like our noblest hopes and dreams, it will transcend them.

Personal immortality—the continuance of our conscious life—the development of that which is noble in us, and the elimination of that which is base,—a human society cleared of all that now perplexes and degrades it, where the highest level that our relations reach at moments here has become the common level of daily life—this picture seems to paint indeed the Kingdom of God; yet only the lesser things are in it. The greater possibilities—the growth of faculties of appreciation of spiritual things, which we now perceive dimly if at all,—exceed our imaginative powers—"it doth not appear what we shall be."

Here, then, I rest my case. Whether we base our belief in immortality mainly on the fact that Jesus believed in it and taught it, or on our belief that God is just, or on our conviction of the surpassing bounty of His ways, we have abundant grounds for a reasonable faith. And, when immortality becomes for us no longer a matter of academic discussion, but the most vital of all questions; when those whom we love, and, in our time, we ourselves, must pass into the future; we shall find our comfort where so many before have found it, in the ancient words, "*In manus tuas, Domine.*"

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